The
# Chemical Age

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## Chemicals & Capital

IT is possible to divide the more or less continuous period of inflation since 1939 into three chapters. First, the wartime chapter, during which a stringent system of controls held back (for the time being) many of the effects of rising prices and costs. After that came the post-war chapter in which a number of wartime controls were gradually removed and when new or revived production had to find its economic balance in terms of real costs and prices. Now the third chapter has begun; and the financial consequences of re-armament as the new inflationary influence must be honestly described as unpredictable. At the very least there is a grave risk that the controls required to stem further inflationary pressure will prove to be rather less than practical politics in peacetime. In any case, such controls are unlikely to be effective over long periods; they are no more than first-aid devices and the pressure that is held back at one critical point eventually manifests itself at some other point.

The new excursion into inflation seems likely to present greater dangers to the chemical industry than the two previous excursions. It is often said that industry's general answer must be greater productivity. It is true that this will help to shift the equilibrium in which more and more money chases available goods. But the chemical industry has been making very great advances in productivity for some years and in many cases high expenditures of capital upon new plant were necessary to obtain further advances. The situation can be expressed in quite simple terms. An old plant may be capable of great improvements; it may be obsolete to the extent that lowered costs and greater output per man-hour can only come from an entirely new plant in its place. But the old plant has been paid for, and in all probability it cost only a fifth or a quarter of what it would cost today and perhaps only a sixth or seventh of what it will cost in a few months' time. The costs of new plant cannot rise above a certain level (in terms of old costs) without forcing a dangerous revival of "make-do-and-mend", a policy that hardens the arteries of all industry but is especially mortal to the chemical industry. The world inflation that has taken charge of metal prices since the autumn of 1950 has an acute bearing upon the costs of modern chemical plant in the construction of which alloys and metals that are fairly

expensive even in normal times are so often required.

At the same time the raw material supply for the industry has deteriorated. The immediately critical material is sulphuric acid. The rising demands of re-armament can be expected to bring others and to increase the pressures upon already limited materials such as coal and electricity. Expansive programmes planned a year or two ago must not only face greater capital requirements for their plant, but also uncertainties in the supply of materials to feed the plant when installed. This may not be true of all expansion plans, but it will apply to many of them.

Nor is this all. The prices of many chemicals used in the industry as initial or intermediate materials have been rising sharply in the new phase of inflation. Keeping a factory reasonably stocked with these materials requires more working capital. Small and medium sized companies are finding that this running drain upon capital taxes their capital-procuring abilities to the full. The amount of capital invested in the chemical industry per worker has always been much higher than the average for all industry. The 1949 plans for expansion involved a considerable jump in this ratio; the impact of 1950/51 costs will make the jump more aptly describable as a leap.

The forthcoming budget will indicate, if not entirely reveal, the pattern of capital movement for the future. Since the beginning of the year there have been a number of grim warnings of austerity to come. It is difficult in any case to see how a new re-armament programme can be paid for except on a PAYE basis. The future is already heavily mortgaged; the past has been largely sold; unfortunately the present is highly taxed also. Any severe increases in taxation that discourage the investor or that reduce the ability of companies to plough back profits into their own productivity will inevitably impose contractions upon the chemical industry. Indeed, for the chemical industry to continue successfully its expanding contribution to national economy, a budget that encourages investment and ploughing-back profits is badly needed. It might be said that this is true of all industry; but no large branch of British industry can make a greater export-trade contribution per worker, and no industry other than the coal industry exerts such a diverse influence upon the costs and efficiency of every kind of home manufacture.

# On Other Pages



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# Notes & Comments

## Differences Not Resolved

ALTHOUGH the American desire for complete de-cartelisation has been modified, there is no certainty that these compromise proposals will lead to a decision by the High Commission. Some differences between British and American experts have not been resolved; the German Government opposes some of the detailed proposals and it is reported that the German point of view, which is primarily economic, has British support. The French attitude on the High Commission may be a vital factor. A not unimportant difference between the British and American policies concerns management of the new groups. The Americans favour complete change; the British prefer to leave management in the hands of men already doing the job effectively. There is, too, the growing demand from the Germans themselves that labour should be given a voice in management. Even if agreement is eventually reached, the Farben complex may remain intact for a good deal longer. It is believed in some quarters that any decision to transfer ownership will be challenged in the international court. The German shareholders have already had their holdings frozen since the end of the war, however, and they may prefer the High Commission's thaw and separation to an uncertain continuation of the present ice-bound cohesion. It should not be supposed that the existing Farben organisation is as large as that of 1939-1945. There was during the war a considerable extension into Eastern Germany and Poland. Just over half of the Farben assets were in Russian-occupied territory and all these segments of the combine have already been detached, some by wartime destruction, some as reparations, and the rest by conversion into East German or Soviet agencies. Many of the shareholders, most of whom are in West Germany, contend that these Eastern losses have already reduced the size and monopoly powers of the Farben empire quite sufficiently. It is not cynical to conclude that in chemical economies, as in chemistry itself, it is easier to synthesise giant molecules than it is to split them up again into undamaged entities. The disintegration of big molecules, whether natural or synthetic, generally involves considerable destruction.

## Chemists and Contracts

PROBABLY no man in this country is, or ever has been, in a better position to discuss the terms of engagement of chemists than Mr. R. L. Collett, the Registrar of the Royal Institute of Chemistry. By now the number of chemists to whom his advice has at some time or another proved invaluable must be a matter of thousands rather than hundreds. The publication of his recent paper on this subject (*Journal of the Royal Institute of Chemistry*, 1951, 75, 1) —a personal rather than official appendix to the Institute's previously issued Notes—is of importance to both chemist and employers of chemists. It should in particular be studied by smaller companies who may in many cases be employing a full-time chemist for the first time; the chemist, too, may be a young man entering into significant responsibilities for the first time. A casual arrangement may seem to sow the seeds for friendly association more readily than a formal and multi-claused agreement, but in the long run a clear and fair agreement will prove to be a better foundation for happy relations. Neither chemical progress nor commercial changes can be predicted; the understanding that seemed admirable once may lead to dangerous misunderstandings after a few years of development. Much of Mr. Collett's wise advice can be said to follow in analogy the old saying, "Marry in haste, repent at leisure." Some potential beneficiaries from Mr. Collett's paper may feel that any advice that emanates from a professional institution must be wholly concerned with safeguarding the interests of its professional members. In fact, of course, members of the Royal Institute of Chemistry will be found on both sides of the employer—employee equilibrium. Numbers of senior members are employers, directors, or act for employers

in engaging other chemists. It can certainly be assumed that the point of view of the employer has always been clearly and fairly expressed in the deliberations of the Institute. In any case, no professional body would wish to devote its general attention to cases in which the employer and employee approach their association as a kind of cold war agreement sealed in suspicion. The function of the Royal Institute in this matter is to make as widely known as possible those general principles that should apply in order that chemists and commercial companies or chemists and corporate bodies shall work happily and mutually advantageously in partnership. There is no question of detailed and standardised terms of engagement and agreement; the Institute does no more than suggest, from long experience, the more important matters that should be covered when an agreement is made. No man could express this more clearly and impartially than Mr. Collett.

## *No More Warming Pans*

THE latest list of articles prohibited by the Ministry of Supply if they contain any zinc, copper, or their alloys, contains depressing news for a very wide assortment of people. It is inspiring to see the completeness with which the Ministry of Supply has docketed the many individual requirements of everyone's daily life, and the amount of careful thought that has gone into this all-embracing document should give the most hardened anarchist cause for admiration. No one alive today need fear that he has been forgotten, or his trifling needs overlooked. As long as he goes on having baths, opening bottles, drinking tea, and hanging his hat on a hook when he comes into the office, his personal habits will begin to feel the pinch sooner or later. Indeed, even if he possesses nothing but a toasting fork, a corkscrew and a bronze statuette of Uncle Henry, he will soon find himself unable to replace them. Everyone from the butcher and the baker to the candlestick-maker is affected by this list—especially the candlestick-maker, who can no longer make either candlesticks or candelabra if they contain zinc or copper—and if anyone is the proud possessor of a family escutcheon, let him make the most of it. The next batch will be in galvanised tin, if he can get it. Sporting folk, strangely enough, seem to be relatively undisturbed. Only the tennis player, who will shortly be unable to wind up his net, the discus-thrower who will have his discuss melted down for the zinc, and the golfer who is, of course, allowed irons, but not putters, will find their game curtailed. The javelin-thrower, the darts champion and the curling enthusiast would seem to be fairly safe until the next list comes out. Misers will not be particularly pleased, since their deed boxes will soon be of the rustable variety, and the intractable bureaucrat will be even less happy as rubber stamps, drawing pins, filing tags and paper weights are all on the list. The only comfort to be derived in this maze of restriction (and it is only a palliative) is that the *Trade and Navigation Accounts of the U.K.* show that the production and export of aspirin have increased this month. Small wonder.

## *The Farben Empire*

THE High Commission in Germany will shortly be faced with the problem of I.G. Farben, probably the world's supreme example of economic polymerisation. The final recommendations of allied experts are said to have been completed and their report offers a compromise on the previous disagreements between American and British policy. It is believed that the principal recommendation is to reverse the original merger of 1925 when the Farben complex first assumed giant size. This would re-create three separate and large companies, one in the Ruhr, one in the Frankfurt region, and the other in Ludwigshafen. There would still remain a substantial and diverse portion of the Farben complex and it is further proposed that this residue should be split up into six separate and smaller companies. Among these are the Agfa photographic film and camera industry, the synthetic fibre industry, the Hüls chemical works which produced synthetic rubber, and the chlorine and plastics group at Rheinfelden.

# The Analysis of Pyrethrum

## Colonial Products Advisory Bureau's Report

PUBLICATION of the Colonial Products Advisory Bureau's Report on an international collaborative analysis of pyrethrum flowers (obtainable from the Bureau at the Imperial Institute, London, S.W.7, price 4s.) has shown that purely chemical methods of estimation cannot readily evaluate biological materials. If the sub-committee initiating and controlling this investigation hoped to establish one of the several methods for pyrethrum flowers analysis as a reliable international standard, those hopes have certainly not been fulfilled. Nevertheless, the investigation was a commendably bold venture and no reader of the full Report will fail to be impressed by the thoroughness with which it was planned and executed. In science perhaps nothing is sadder than the first-class experiment that produces inconclusive results.

The need for a single test for pyrethrum flowers' content of insecticidal material is obvious. Trade in this natural product is international. Commercial practice requires an agreed and reliable standard of reference for assessing the real value of material bought and sold. The Colonial Products Advisory Bureau wisely attempted to obtain the co-operation of all interested countries, particularly that of the principal buyer, the United States. Samples of two different Kenya pyrethrum crops were sent to collaborating companies and institutes in the U.S.A. and Canada, in Britain, in Europe, in Africa, India, New Zealand, and South-East Asia. Forty-two reports from collaborators were finally received.

### Methods of Analysis

Three methods of analysis were applied to each of the samples—the Seil, the Mercury Reduction, and the Ripert methods. To secure international agreement in details of these methods, slight modifications in all three were agreed beforehand. Owing to the problem of using petroleum ether boiling below 40° C. in tropical climates, it was also agreed, after satisfactory investigation in England, to substitute normal hexane as a solvent in the mercury reduction method. The samples were uniformly prepared by a British company in co-operation with the Sub-committee; the care with which this all-important part of the investigation was carried out will be an object lesson to all bodies who attempt similar large-scale investigations of analytical methods. It is an ironic comment upon the age in which we live that the despatch of these samples was in several cases followed by transport difficulties—customs delays, off-loading en route, etc. Some collaborators never received essential re-agents sent to them. When so much scientific pre-preparation has been invested in small lots of material and re-agents, it is deplorable that the simple operations of twentieth century transport should break down!

### Experimental Results

The statistical examination of the results from all these tests showed that the mercury method gave consistently higher results for both pyrethrins (I and II) than the Seil method. The Ripert method gave lower results for pyrethrin I than either method and its results for pyrethrin II were too variable for useful comparison. In general the Seil method gave slightly more consistent results. Variations between determinations in the same laboratory were about the same for both the Mercury and the Seil method; but variations between different laboratories with the Seil method were less for pyrethrin I and greater for pyrethrin II. Clearly, the results showed that the Ripert method disqualified itself; but the sub-committee properly concluded that no recommendation could be made for the preferential adoption of either the Mercury Reduction or the Seil method.

It seems essential for both buyer and seller to agree beforehand whether the standard of reference in a transaction is to be the Mercury or Seil test. The sub-committee suggests that differences of up to 0.3 in determinations carried out by two different laboratories should be regarded as insignificant in estimations of flowers containing between 1 and 2 per cent of total pyrethrins. Even under the rigid conditions laid down for procedure in these tests the inter-laboratory variations gave a high standard error. After all, 0.3 in a total

value of 1 or 2 per cent is a variation of some 20 per cent in total value; and the commercial profit in a transaction may itself be less than 20 per cent.

Further than this, there is in commercial practice a much greater probability of variations caused by sampling. In these planned tests every possible effort was made to eliminate this cause of variation. It must be concluded, therefore, that any commercial dispute over the pyrethrin content of pyrethrum flowers would be unprofitably pursued in a court of law; for in this Report alone there is abundant ammunition for any competent counsel to dispose of expert witnesses!

### Comment on Results

Perhaps the most interesting part of the Report is the comments of the Sub-committee upon their somewhat negative conclusions. It is pointed out that the terms pyrethrin I and II are omnibus terms; that various keto-alcohols form esters with chrysanthemic and pyrethric acids to become the total mixtures known under these group names. The accepted chemical methods of analysis aim at isolating chrysanthemum mono—and di-carboxylic acids, assessing these, and equating the results with 'pyrethrin figures' by using conversion tables. Such methods cannot precisely assess the biological (here, insecticidal) values of the materials. It is said that 'in absence of an absolute chemical method for the determination of the pyrethrins and, since the material is purchased for its biological effect, the results of any arbitrary chemical method of assay must be correlated with biological effect.' It is possible to criticise this conclusion. Even if an absolute method for estimating the pyrethrins was available, recourse to biological correlation would surely still be required? Is our knowledge of pyrethrum so complete that the entire insecticidal effect can be attributed to the pyrethrins and to no other natural factor or substance? The past few years have seen the emergence of cinerin I and cinerin II. Other factors may still remain to be uncovered. Also, as more recent tests have shown, synthetic, semi-synthetic, and natural forms of cinerins or homologues vary in their relative toxicities to insects according to the test-insect used. The Sub-committee apparently hopes that absorption spectra methods or partition chromotography may lead to an absolute method of estimating pyrethrins. But would such a method, however successful, remove all the complications?

There are much simpler examples of the failure of chemical methods to provide accurate or consistent measures of biological values. For over a century inorganic methods of analysis have assumed a totally unjustified authority to measure the biological value of phosphates in crop nutrition. Such tests and assumptions are not only accepted in commercial practice, but have become embodied in fertiliser legislation. In different countries different tests and standards of extraction or solubility are accepted. Contracts between buyers and sellers are based upon these estimates of value and price adjustments are calculated from analysis results. The results of analyses are frequently given to the second place of decimals. Yet any attempt to correlate such impressive precision with field evidence would fail significantly. A price differentiation is made for a difference in percentage content of 0.5 per cent—legal penalties can fall upon a seller for divergences of 0.5 per cent or 0.75 per cent from stated contents. But in the field, even in the most carefully conducted tests, differences in effect from materials varying by 2 per cent in their content of phosphoric acid could not be demonstrated. If in so relatively simple a case chemical methods cannot accurately measure biological effects, it seems difficult to visualise any advances which will enable chemical or non-biological methods to measure the complex insecticidal powers of natural pyrethrum.

### Biological Variation Errors

In some opinions this problem is a disability of natural materials which are used for a specific activity. When a synthetic substitute becomes available, the less variable and less mixed composition of the synthetic lends itself more easily to standardised analytical tests. It is true that laboratories may be able to obtain less varying figures because such materials are less complex in nature. It should not be forgotten, however, that greater 'decimal point' consistency in the laboratory means nothing unless there is also close correlation with biological values. Synthetic insecticides are equally subject to this variation.

# Toxic Agricultural Chemicals

## Precautions for Protection of Workers

PROBLEMS concerning the health and safety of agricultural workers have become increasingly important with the introduction of new sprays containing substances which may have ill effects if absorbed in use.

Need for more stringent precautions when using toxic substances in agriculture was recognised by the Ministry of Agriculture and Fisheries, and a conference with organisations and departments concerned was held in July last year. As a result a Working Party was set up under the chairmanship of Professor S. Zuckerman, C.B., F.R.S.

The report of the Working Party has now been submitted and is being considered by the Minister. It deals with dinitro weed-killers and organo-phosphorous insecticides and will be published as soon as practicable.

In the meantime, because of the need to lose no time in concerting measures for the 1951 spraying season, the Ministry has held a further conference with representatives of farmers, farm workers, manufacturers and contractors and other Government departments interested, to discuss the recommendations of the Working Party and what action should be taken, pending full consideration of its report.

### Measures to be Taken

Protective clothing must be provided and should comprise the following: overall of white cotton or similar material, fastening at the neck and wrists, a white cloth hood to cover the head and the back and sides of the neck; coat, apron, gloves and boots of rubber, or other materials shown by their manufacturers to give an equal degree of protection equal to that of natural rubber; eye-shield; respirator and sou'wester.

For various operations the clothing laid down is.—

*Mixing*: Overall, rubber boots, apron and gloves. When mixing takes place indoors, a respirator should also be worn; out of doors, an eye-shield should prove sufficient.

*Spraying*: *Crops*—Overall, hood, eye-shield, rubber boots and gloves. *Trees*—A sou'wester and rubber coat should be worn in the place of the overall and hood. Otherwise the same.

*Greenhouses*: If the manufacturers' instructions regarding the use of smoke generators in greenhouses are followed and the operator avoids inhaling the fumes during ignition and adequately ventilates the greenhouse before re-entering, he need not wear protective clothing, but should carry a respirator at the ready position. If a greenhouse is entered while poisonous smoke or spray is present, overall, hood, rubber boots and gloves, and a full-face type of respirator should be worn. Workers applying sprays in greenhouses should be similarly equipped.

*Tractor Spraying*: *With air-conditioned cab*, the driver should wear overall and rubber boots. *Without air-conditioned cab*, sou'wester, coat, boots and gloves of rubber, and an eye-shield should be worn, and similar equipment should be worn by the worker riding on the sprayer in order to attend to the spray nozzles.

*Washing Facilities*: Soap, clean towels and clean water should be provided near the scene of spraying operations, but sufficiently removed to avoid any contamination from spray drift. Care should be taken to avoid interchange of towels among workers. Running water should be used if available. Alternatively, clearly marked separate containers should be provided for washing (a) protective clothing other than overall and hood; (b) the face and hands.

*Working Periods*: No worker should do more than 10 hours' spraying a day, even when it is necessary to work overtime, or work more than six successive days on spraying operations. No worker should be engaged on spraying operations while he is suffering from such complaints as a cold, bronchitis, or stomach upset.

*Supervision*: Every person employing workers on the agricultural use of these substances should make proper arrangements for their supervision and instruction.

*Meals*: All workers engaged on spraying operations should be forbidden to eat, chew or drink in the spraying area, or to smoke while on their work.

*De-contamination of machinery and equipment*: Spraying machines, hoses and spraylances should be washed with water plus suitable 'wetters' before repairs are made, and at the end of each shift; tanks and containers should be washed thoroughly at the end of each shift. In no circumstances should the workers clear blocked jets by blowing out with his mouth.

# Modern X-Ray Analysis

## Group Studies Recent Applications

AT a meeting of the Physical Methods group of the Society of Public Analysts on Tuesday, 6 February, three papers concerning the applications of X-Ray analysis in modern research were read.

In the first, 'Some examples of X-Ray analysis in Atomic Energy Research,' J. Thewlis, D.Sc., said that by the use of X-Ray analysis it was possible not only to determine the arrangement of atoms within a substance, but to distinguish between solid solutions and mixtures, to estimate crystal sizes, to determine the degree and nature of any preferential orientation that might be present, and to study the effect of various processes on all these.

The electron distribution in graphite was studied by means of X-Ray analysis and neutron diffraction, and it was found to be asymmetric. The X-Ray powder photographs of $\beta$-uranium, which were shown at the meeting for the first time, showed the nature of the three structures of the element, and X-Ray analysis contributed considerably to the study of plutonium chemistry.

The second paper had as its subject 'X-Ray diffraction study of interfacial compounds formed in radio valve cathodes,' and was read by Miss Y. Budge, B.Sc. The cathode, being the source of emission, said Miss Budge, formed the 'heart' of a radio valve. An oxide cathode was prepared by the application of an alkaline earth oxide mixture to a metallic base, and a study of the electrical behaviour of oxide cathodes indicated the presence of interfacial compounds.

### Interfacial Compounds

X-ray diffraction methods of analysis lent themselves to the examination of these reaction products. The method described used a standard circular powder camera for X-ray surface reflection photographs, and with the cathode in question possessing either a tungsten or a nickel alloy base, the interfacial compounds fell into two groups. With tungsten, the reaction occurred with the base metal itself. With nickel, the reaction was between the coating and the impurities deliberately or accidentally contained in the nickel.

The third paper read to the meeting was 'Some analytical uses of X-Rays,' by H. J. Dothie, B.Sc., A.R.I.C. The diffraction of X-rays by a crystal, said Mr. Dothie, arose from the scattering effect of the charged particles composing the units of structure, of which the planetary electrons had the predominant effect. The interference maxima, or 'reflections,' were governed by stringent conditions, which could, however, be satisfied either by rotating a single crystal or by using a powder in which the many crystallites were randomly oriented. The powder pattern was characteristic of the compounds present, and could be used in qualitative analysis.

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*IN THE EDITOR'S POST*

## An Unfortunate Confusion

SIR,—In your publication of 6 January last, you reproduced a letter concerning Tricresyl Phosphate.

All concerned should know that tricresyl phosphate is not an antiseptic and no claims have ever been made that it is. Among those who deal in it and handle it, it has been widely known as T.C.P., certainly since the 1920's and it is most unfortunate that at this date there is still confusion between this and the material marketed as an antiseptic under the initials T.C.P.

Recently a move has been made that the plasticiser should be known by the name favoured by the Chemical Society—Tritolyl Phosphate—and if the initials T.T.P. are adopted for this there will be a distinct lessening of the unfortunate confusion which exists at present.

F. H. MACKENZIE,
Director.

A. Boake, Roberts & Co., Ltd.

*Editor's note: In the letter mentioned above* (THE CHEMICAL AGE, 6 *January*, 1951, *p.* 6) *a correspondent reported that he had heard of a certain factory where, it was alleged, people worked in an atmosphere of tricresyl phosphate fumes, because the work's doctor knew that 'T.C.P.' was a good antiseptic.*

# Recent Vitamin Research

## Biological Action of Thiamin

AN important contribution to vitamin research[1] (*Angew. Chemie*, 1951, *63* (2), 37-40, 21 January) has recently been made by one of the world's leading workers in this field, Professor P. Karrer, of Zurich University, a name well known to all students of organic chemistry. Although the constitution of many biologically active substances has been established, their precise mode of action in the organism in many cases remains yet unknown. This applies very definitely to vitamin $B_1$ (thiamin) which undoubtedly takes part in many different cell reactions, including carbohydrate metabolism.

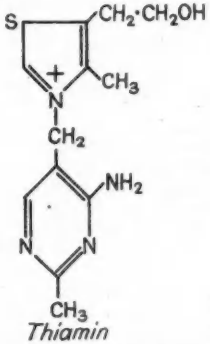
Much work has already been done in this direction. Lipmann and Erlenmeyer experimented with sodium dithionite ($Na_2S_2O_4$) in an attempt to form dihydrothiamin which, with thiamin, they thought, might form a Redox system in the cell. Karrer and co-workers, however, found later (*Helv. chim. Acta*, 1945, *28*, 1523) that sodium dithionite does not convert thiamin hydrochloride into a dihydro derivative but quantitatively into its thiazole pyrimidine components, other thiazolium salts behaving in the same way.

In 1940-41, O. Zima and R. R. Williams supported the theory of a Redox system in the cell because their reduction of thiamin with sodium alcoholate produced the thiol and disulphide forms. Both these appeared in biological tests to be about equally effective as vitamin $B_1$ factors, so it seemed reasonable to suppose that they were mutually interchangeable in the living cell, and that the action of thiamin was closely related to that of a Redox system.

### Redox Theory not Substantiated

In the cells thiamin is present at least in part as a pyrophosphoric ester, namely, co-carboxylase. Whether this performs in the animal organism functions analogous to its rôle in alcoholic fermentation, namely, decarboxylation of pyroracemic acid, is, however, very doubtful. It seems more likely that it takes part in certain synthesising operations, with the formation, for example, of oxalacetic acid.

Karrer and co-workers, working along the same lines as Zima and Williams, converted not the thiamin but the co-carboxylase into the corresponding thiol and disulphide forms (*Helv. chim. Acta*, 1946, *29*, 711, 1982). The thiol form, they found, had about the same co-carboxylase activity as the original itself while the disulphide was completely inactive, but could by reduction be at least partly reconverted into the active thiol form. From this evidence it would seem that the Redox system hypothesis is invalidated. Nevertheless, the possibility that the oxidised disulphide form of thiamin has some biological significance is not quite excluded, although it seems improbable.




*Thiamin*

In the course of this research it was found (*ibid*) that the production of co-carboxylase could be simplified. Meta-phosphoric acid is first formed by heating ortho-phosphoric acid to over 350°C., and thiamin is then introduced at 100°C. It is known that the meta-acid exists in several polymeric forms, and that when reacting with thiamin it is evidently in the trimeric cyclic form. The resulting thiamin triphosphate, as Velluz has found with the same reaction, readily splits off one molecule of phosphoric acid and thus passes easily from co-carboxylase phosphate (the phosphoric acid salt of thiamin di-phosphate) to co-carboxylase itself, from both of which compounds the chlorides can easily be obtained. Both di- and tri-phosphates of thiamin have about the same co-carboxylase activity.

In order to discover if there was any analogy between the action of thiamin and co-carboxylase, and their homologues, Karrer and his co-workers prepared by the above method the triphosphates of 2′-des-methyl-thiamin and the 2′-ethyl homologue. Schultze, some ten years earlier, had already investigated the vitamin $B_1$ action of the *thiamin* homologues (*Hoppe-Seylers Z. physiol. Chem.*, 1940, *265*, 113), and found that the ethyl compound in pigeon-feeding tests exhibited high vitamin $B_1$ activity, even exceeding that of thiamin, while the methyl compound had only about 1/20th of the thiamin potency.

### Co-carboxylase Not Analogous

Karrer, however, compared the triphosphoric esters of the homologues with co-carboxylase itself (thiamin diphosphate) and with thiamin triphosphate, *in vitro*, and found that the 2′-ethyl homologue had only about 25 per cent of the co-carboxylase activity of thiamin triphosphate, and that the 2′-des-methyl compounds showed even lower activity. We must conclude, therefore, that although in broad outline there is some parallel between vitamin $B_1$ and co-carboxylase action, appreciable quantitative differences exist, and that this co-carboxylase effect by no means represents the whole of the action of vitamin $B_1$ in the organism. It evidently has wider biological functions.

Considering next the breaking down of vitamin $B_1$, Professor Karrer refers to its deactivation by the Chastek factor, and to the work of C. A. Evans and his co-workers with deactivating ferments present in the spleen, and in the muscle tissue of certain fish. Foxes fed with raw fish in these experiments exhibited vitamin $B_1$ deficiency, or avitaminosis, and were restored by intake of thiamin. Earlier research in this direction was undertaken by Krampitz and Wolley, but more recently by Weswig; Thomas and Walker; and W. Charles Evans and E. T. Rees Evans.

The latter workers (*see Brit. Vet. Journ.*, 1949, *105*, 175) found that certain varieties of fern, such as *Pteris aquilina*, contain a substance that breaks up vitamin $B_1$. Although it is relatively heat-resistant, this appears to be a ferment, and may be the cause of symptoms of vitamin deficiency in horses, cows and other animals. It is unknown whether the poisonous principle is the same as that found in carp and possibly other fish muscle, but in any case, fern poisoning, which has been fairly common in some countries, can be eliminated by the administration of vitamin $B_1$.

Similar antivitamins have also been found in other plants; for example, in *Equisetum arverse* (corn horsetail), bog shave grass, etc. (*Helv. chim. Acta* 1948, *31*, 1062; 1949, *33*, 957, 2397). Among the possible substances or sources of these substances has been included an alkaloid of unknown constitution—polustrim. Others have been isolated by Karrer from a species of *Equisetum*, including a dimethylsulphone of special interest. Nicotin also is often present, and this joint appearance of nicotin and palustrin in the same plant suggests some relationship between the two, although from the point of view of animal poisoning or avitaminosis, both the content and toxicity of these two substances in shave grass is relatively small, and it is by no means certain that they are wholly or even partly responsible.

Professor Karrer has also investigated the reduction of thiamin with lithium-aluminium hydride, in view of the comparatively negative results obtained by Lipmann and Erlenmeyer with sodium dithionite. This hydride has been useful for the conversion into their o-dihydro derivatives of many quaternary salts of cyclic bases, and it was hoped that it would be equally effective with thiaminchloride.

### Preparation Successful

Working with tetrahydrofurane he found it was possible to obtain approximately 25 per cent yields of crystalline dihydrothiamin (*Helv. chim. Acta* 1950, *33*, 555). This appears to be the first 2,3-dihydro derivative of a thiazole compound to be prepared (those hydrogenated in other positions are already fairly well known and are obtainable by other methods). Further, by reducing other quaternary thiazolium salts with $LiAlH_4$, he found that the corresponding 1,2-dihydrothiazole derivatives may also be produced.

Various biological tests with dihydrothiamin on rats showed that it possessed a characteristic vitamin $B_1$ effect, but to a much smaller degree than thiamin (about 1/15). Against micro-organisms its action varied. Some results were given by Professor W. Schopfer of Berne in a private

[*continued at foot of opposite page*

# Progress in Gas-Making Plant

## A Record of One Hundred Years of Endeavour

THE success and prosperity of British industry today is largely based on firms which owe their development to the pioneering spirit of private enterprise. It was undoubtedly the inventive ability and purposeful initiative of William Cartwright Holmes which set the course for the business of W. C. Holmes, Ltd., Huddersfield, which has endured for a century.

To mark the occasion the company has issued a handsomely produced book entitled 'The Story of One Hundred Years of Endeavour in the Service of the Gas Industry.'

Towards the end of 1850, the firm was established at Whitestone Ironworks by William Cartwright Holmes, then only 23 years of age. Patents dating from 1853 onwards were taken out by him concerning 'Improvements in the Manufacture of Gas and Apparatus employed therein,' which led to a new and simplified type of gas plant.

### Gas from Coal

Among the examples of his creative ability was one which covered the production of gas from coal simultaneously with the addition of steam, thus generating water gas in the retort as in present day vertical retort practice.

In 1880 the works was moved to the site at Turnbridge, which then occupied an area of only 1,900 sq. yds. The present area is about 10 acres, nearly 25 times that of the original site.

Experimental activities have provided the substance for the continual development of W. C. Holmes & Co. For this reason the experimental branch, encouraged in the earliest days by the founder, has always been fostered and has led to the introduction of a number of new processes of value to the gas industry.

In recent years a separate research organisation has been created, where both pure research and experimental, up to the pilot plant stage, are carried out.

The first commercial plant for the improvement of ammonia-still effluent in this country was constructed by Holmes for the Manchester Corporation Gas Department, and installed at the new Partington Works in 1929. Shortly afterwards the second installation was made for the chemical works attached to the Glasgow undertaking.

In 1930 the company designed and produced a simplified type of benzole recovery plant.

Tower purifiers originated in Germany, but the first set of this type in Great Britain was installed by the company at Wandsworth Gasworks.

A process for the removal of organic sulphur compounds from towns' gas was introduced in 1937. Research developing into full scale operation was carried out at the experimental station at Mirfield Gas Works, where the patents of Dr. Maxted, of Bristol University, were exploited. The process has been applied to the treatment of towns' gas used in industry, principally in the manufacture of special glasses, and for the heat-treatment of non-ferrous metas.

One of the company's latest products is a flexible coupling for use on all types of industrial, traction and marine drives. The coupling, for which patents are pending, is marketed under the trade name of 'Holset.'

## Recent Vitamin Research

*continued from previous page*

communication, when he stated that its potency ranged from 1/4th to 1/60th of that of thiamin.

Finally, writes Professor Karrer, Langenbeck's theory that the nature of thiamin activity is a union of its amino group with the keto group of pyroracemic acid to form a Schiff's base, followed by decarboxylation, is neither proved nor disproved due to insufficient evidence. There is, however, something to be said for the idea of transamination. Braunstein showed in 1937 that this does actually take place between amino-acids and α-keto-carboxylic acids and the general idea to-day is that Schiff's bases are formed (union of a primary amine and an aldehyde), and that after local displacement of the double bond these are split into new amino-acids and new keto-acids. (Cohen and others, *J. biol. Chem.* 1941, *140*, 711; 1945, *161*, 559; and Karrer *et al. Helv. chim. Acta* 1941, *24*, 127,861; 1942, *25*, 595, 1,149).

# Oil and Colour Chemists

## *Presentation to Past Presidents*

THE occasion for the dinner given by the Oil and Colour Chemists' Association on 21 February, was for the presentation of a replica of the presidential jewel to each of their past presidents. The reigning president, Mr. John Crombie, presided, and there were present two welcome visitors from France—M. Lucien Ravell and M. G. Deschaux, of the F.A.T.I.P.E.C.

The President, making his speech, said it gave him great pleasure to bring together all the past presidents of the Association, as members were apt to lose touch with them through the passage of time. Indeed, it was a historic occasion, as he could not remember any other time when all the living past presidents but one had gathered together under one roof. He then made the presentations and proposed their good health.

### Past Recollections

As the senior past president, Dr. J. Newton Friend (1922-24) expressed his gratitude for the honour bestowed upon him, and referred to several of the members present who had been his supporters at the time when he held office. At that time the association's dinners had been held at the Holborn Restaurant, and he remembered the late Professor H. E. Armstrong informing members present that they knew nothing about chemistry as they could not tell him what caused the paint in his scullery to crack.

Mr. H. Houlston Morgan (1924-26) also replied to the toast, recalling the inaugural meeting at St. Bride's Institute on 18 May, 1918. Many proposals had been considered at that time, he said, but the association had ultimately and, he thought, rightly, been founded along scientific lines, scientific training being decided upon as a qualification for membership. They had also instituted associate membership, and set out to form local sections.

Dr. H. W. Keenan (1944-47), who also spoke, remarked on the necessity for attracting young labour into industry to fill a 'horrible statistical gap' in the birthrate in this country. If there were no schemes for training more apprentices, he said, then industry would be likely to lose all the potential young labour available between now and 1960. He cited the work of his friend, Mr. Campbell, in the printing ink industry, as an example of what should be done in this direction.

Dr. L. A. Jordan (1947-49), replying for the recent past presidents, described the conception of the presidential jewel. The origin of the Leonardo Da Vinci head on it, he confessed, he did not know, but the motto 'Et Mente et Manu'—'By Mind and Hand'—had been debated by twelve of the most eminent Latin scholars available in London over coffee in the Athenaeum Club. The symbol of Leonardo Da Vinci stood for the difficult but desirable union of science and art—the basic principle by which he thought we ought to work. Mr. R. J. Ledwith also spoke, and welcomed the two distinguished French guests, preferring to call them 'étrangers' rather than foreigners. M. Deschaux and M. Ravell both replied, thanking the members of the O.C.C.A. for their kind invitation, and asking them cordially to attend the forthcoming congress in Paris from 3-6 June, when the subject for discussion would be fire-resisting and fire-retarding paints.

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## *Salt Mine Under a City*

FAR below the busy streets of the city of Detroit, miners remove more than 4,000 tons of salt every day from a huge air-conditioned mine, which has been in operation 44 years and is now one of the most modern in the world.

Located 1,100 ft. below the city, the mine, which is owned by the International Salt Company, contains a layer of dry salt 35 ft. thick. It is reached by means of two large elevators, eight miles apart.

There are about 60 miles of illuminated corridors. Each is 50 ft. wide, and 23 ft. high. Giant pillars of salt, left standing when the tunnels were dug, provide support for the roof. Because trucks and automobiles are used in the mine, stop signs, traffic lights, and other safety signals are placed at intersections, just as on surface streets. A railway runs down the main corridor between the two lift shafts.

The miners use modern drill rigs to bore holes for dynamite charges in the salt vein.

# U.S. Study of Radioactive Wastes

## Observation by Remote Control

THE new 'Hot' laboratory building at the Brookhaven National Laboratory, which has just been completed, is headquarters for processing 'hot' materials, or radio-isotopes, emerging from the pile, or reactor, after bombardment by neutrons. All experiments with 'hot' atoms are sealed off by giant steel doors and scientists make their observations through periscopes.

Designed to separate and analyse radio-isotopes, the new facilities are being used for advanced study of methods of concentrating radioactive wastes, metallurgy problems in reactor development, and other aspects of chemistry and engineering in the atomic energy field.

In a room which might be thought of as a 'prison block' of three cells for 'imprisoning' the hottest of such pile products, eleven-ton steel doors, operated by the flip of a switch, slide silently open and closed. Each pair of doors encloses a stainless steel cell backed up by concrete walls three feet thick. Each door is one foot thick, three and one-half feet wide and 11 feet high. In spite of the massive size, each door will close in five seconds and stop automatically at the correct spot.

Equipment is pre-assembled on a panel which is then fitted into the doors, and later removed for decontamination in special 'clean-up rooms' nearby. Thus, lost time in the 'hot' cell is reduced to a minimum, thereby multiplying the number of actual experiments a single cell can accommodate.

Five caves, or 'semi-hot' cells, of a more

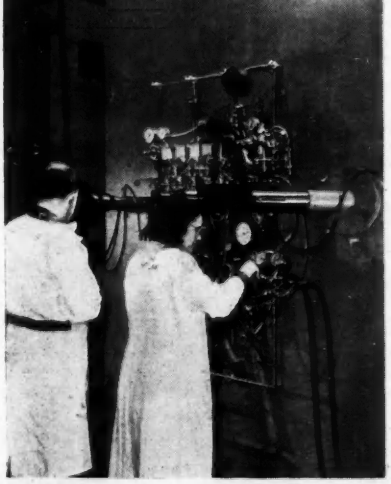
*General view of the area designed to accommodate assembly of big experimental equipment in the 'Hot' Lab at Brookhaven National Laboratory, Upton, N.Y. On the left is an equipment clean-up room. In the right foreground are a crane and lift truck for movement of apparatus*

conventional type are used for work with materials that are not so radioactive. The top of a cave resembles the hood over a kitchen stove. A laboratory technician uses tongs to work with 'semi-hot' atoms behind a shield of lead bricks, with mirrors and thick glass portholes to aid vision.

The 'Hot' Lab's Semi-Works area contains handling facilities and wide floor space for construction and operation of equipment. Its use can range from pre-assembly of 'hot' cell experimental equipment to the building of a pilot plant for evaluation and development of industrial processes.

Samples of materials can be placed in small tubes and whisked underground at 40 miles per hour from the reactor to the 'Hot' Lab, resembling a pneumatic tube change-making system in a department store. Short-lived radio-isotopes can thus be delivered into a hot cell for immediate use, before they lose their radioactivity.

Experimental equipment exposed to highly radioactive substances is taken to a 'clean-up' decontamination room. To make cleaning easier, part of the room is lined with stainless steel, part with tile. When necessary, intensive scrubbing, with soap and water or with acids, takes place in a polished stainless steel dunking tank five feet deep, resembling a miniature swimming pool.



*A technician (left) watching through a periscope while another worker handles 'hot' chemicals by the remote control instruments*

All the ventilating air in the 'Hot' Lab is passed through filters to remove possible airborne contamination.

Waste liquids from experiments pass through drain lines to hold-up tanks, where they are monitored by Geiger counters and similar detection devices, then analysed to determine radioactivity levels. If no significant radioactivity can be detected, the waste is discharged in normal manner through a regular sewer.

### Treatment of Waste

Other wastes are treated and diverted to one of several storage tanks. Radioactivity prevents entry of personnel to the waste treatment area, a labyrinth of tanks and pipes under the 'Hot' Lab building. Pressures, temperatures and other data necessary to supervision are therefore registered on control panels upstairs.

The Brookhaven 'atomic furnace,' an air-cooled, graphite-uranium pile which ultimately will develop heat at a rate of 30,000 kW, is several times more powerful than the reactor at Oak Ridge. Its primary purpose is to produce neutrons for scientific investigation.

In operation an atomic pile becomes a vast reservoir of neutrons and a source of fission products, the radioactive substances into which uranium nuclei are split. The dense population of neutrons inside the reactor gives ample opportunity to gain further knowledge of the neutrons themselves and of substances exposed to them. The neutrons are utilised by inserting materials into the reactor, or by allowing beams of neutrons to emerge under controlled conditions through holes in the shield surrounding the reactor.

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### Sewage as Fertiliser

A scheme to convert the sewage and refuse of the town into fertiliser was outlined by Dr. Griffith Evans, Caernarvon, at a special meeting of the Town Council on 20 February. With this method of organic cultivation, he claimed, every district the size of Caernarvon could become self-supporting and grow its own food. The total estimated cost would be about £80,000.

# 'Labelled' Insecticides in Pest Research

THE advent of radioactive isotopes has provided biochemists with a very powerful tool, which has opened up new horizons for pest research. By 'labelling' insecticide molecules with suitable isotopes, it is sometimes possible to trace very exactly their distribution inside the insects to which the preparation has been applied, and also to determine the nature and ultimate fate of insecticide residues contaminating food. Furthermore, the great sensitivity of these new techniques enables investigations to be carried out at much lower concentrations than are possible by normal analytical methods, and they are therefore much more representative of practical conditions. The fundamental data thus acquired should in time enable the manufacture and application of insecticides to be undertaken with a more precise knowledge of their effects.

Radioactive isotopes are being used at the Pest Infestation Laboratory to study the toxicity of insecticides from two different angles. In the first place, the investigators are concerned with the nature of the residual insecticides which contaminate foodstuffs as a result of infestation measures carried out either by spraying or fumigation. The importance of this work is self-evident. Enormous damage to food is caused every year by insects, and extensive spraying or fumigation is necessary to control the pests.

### Fate of Residues

During growing, storage and manufacture, food is always liable to be contaminated by residual insecticides. The amount of contamination is too small to have any toxic significance, but obviously it would be unwise to rely on that fact alone. For one reason, traces of some insecticides tend to accumulate in the body and are not excreted along with other waste products. It is desirable, therefore, that as much as possible should be known about the ultimate fate of insecticide residues contaminating food and their possible toxicity to mammals.

Investigations are therefore being made to determine the nature and extent of these residues and find out whether they gradually disappear with time, or whether any chemical reaction with the food takes place which might have adverse effects on nutritional value. These research problems involve the identification and determination of traces of an insecticide or its decomposition products in the presence of the relatively large amounts of the biological material of the food. This can often be achieved in a sensitive and specific manner by means of techniques based on the use of radioactive isotopes.

### Experimental Studies

Studies based on a radioactive bromine analogue of DDT were described in a recent paper by F. P. W. Winteringham, A Harrison, C. R. Jones, J. L. McGirr and W. H. Templeton[1]. In these studies the radioactive bromine analogue was used to indicate the fate of DDT contaminating wheat grains which were subsequently milled, baked into bread, and finally fed to animals.

The second line of attack is to study the action of the insecticide and find out how it brings about the death of the insect. The ideal insecticide is one which is highly toxic to the infesting insect but absolutely innocuous to all animals. At present such a one does not exist. It can only be developed within the framework of a very wide knowledge of how insecticides exert their effects generally.

How does the insecticide get into the insect's body? What happens to it when it gets inside? What does it do to the insect—that is, in what way does it interfere with the insect's natural processes and so cause death? Does it destroy the digestive organs, interfere with the excretory processes; or what other effects are produced? All these questions must be answered before the existing limitations of pest control measures can be overcome.

In some parts of the world flies have become so resistant to DDT that the use of this previously effective insecticide has had to be dropped. Some earlier work suggested that when these immune flies come into contact with DDT, they are able to convert the insecticide into a non-toxic substance. In view of the importance of this problem, the fate of DDT in insects has been examined by the new tracer technique.

A radioactive DDT preparation was injected into normal flies and also into specimens brought from Italy and made available through the co-operation of the

London School of Tropical Medicine. By tracing the 'labelled' insecticide, it was possible to determine the amount of unchanged DDT and of any decomposition products resulting from the metabolic processes of the fly.

### Action of Resistant Flies

Evidence so far obtained indicates that resistant flies are, in fact, able to convert DDT into a non-toxic compound, while susceptible flies cannot do so. The effect of repeated applications of insecticide, presumably, is that only the resistant flies survive to breed, with the result that infestation measures became progressively less effective. Before a satisfactory solution to this problem can be found, it will probably be necessary to find out by what means the resistant fly is able to alter the composition of DDT.

Techniques employed in these studies have been described by F. P. W. Winteringham, P. M. Loveday and A. Harrison[2]. The insecticide used is a radioactive bromine analogue of DDT ($Br^*C_6H_4)_2$ $CH.CCl_3$. A method had to be developed for the separation and estimation on the micromole scale of this analogue and the possible metabolites ($Br^*C_6H_4)_2C:CCl_2$, and ($Br^*C_6H_4)_2CH.COOH$. It was important that no decomposition of the unchanged analogue should be brought about by the method of analysis itself. The technique adopted was developed at the Pest Infestation Laboratory and is known as combined radioactive tracer paper partition chromatography.

### High Sensitivity

By means of this technique it has been possible to analyse quantitatively a 'labelled' DDT preparation and any of its derivatives in a single fly. This investigation has necessitated the determination of less than one-millionth of a gram of insecticide. The methods adopted are so sensitive that they can detect one thousandth of a millionth of a gram. This represents a tremendous advance in biochemical research and even permits the analysis of small fragments of nerve fibre which have hitherto defied the most sensitive methods of chemical analysis.

Another method of chromatography has been developed for separating metabolites on a larger scale. The solvent is allowed to diffuse through a column and the compounds come off one at a time and are collected in tubes, so that chemical analyses can also be carried out. This technique may be described as radioactive chromatography plus the additional facility of automatic fraction collection.

Evidence so far obtained by these methods indicates that the following reaction takes place in resistant flies:—

$(Br^*C_6H_4)_2CH.CCl_3 \rightarrow (Br^*C_6H_4)_2CH:CCl_2$

Another technique which has been applied with some success in studying the distribution of insecticides and finding out what tissues they affect, is the autoradiography of water-soluble tracers in histological sections. Useful autoradiographs have been obtained of iodine-131 in larvae poisoned by methyl iodide, which were then dehydrated by the Altmann-Gersh freeze-drying process. After processing, the larvae are cut into thin sections.

### Photographic Test

These sections are then mounted on a microscopic slide, covered with a highly sensitive photographic emulsion, and exposed for several days. The iodine being radioactive photographs itself in the emulsion, so that in effect a photograph of the distribution of radioactive material in the section is obtained. From it various enlargements are taken for further study.

By making an autoradiograph after a few hours the progress of a labelled insecticide can thus be followed. The technique has already shown that DDT is widely distributed throughout the poisoned insect, instead of being localised in the peripheral tissues, as was formerly thought likely, and that the penetration is very rapid. Now that the technique has been mastered, it is hoped that its usefulness can be further increased by using much more sensitive emulsions as used in cosmic ray research.

Other investigators at the Pest Infestation Laboratory are studying those insecticides which are applied to gases and are usually referred to as fumigants. At present they are concentrating on methyl bromide, the object of the experiments being to find out what happens to the molecules after they have been applied to food, what happens to them in the insect, and how they kill it. Elucidation of these fundamental problems will help manufacturers to develop improved insecticides by changing their structure to render them more toxic to insects and less toxic to mammals.

[*continued at foot of page 358*

# Chemical Exports in January

## *Shortage of Raw Materials Not Yet Apparent*

PROBLEMS of shortages of raw materials, which must eventually prove detrimental to overseas trade, have not yet begun to show an effect on exports of the chemical industry. Total value of chemicals, drugs, dyes and colours exported in January was £10,415,993 compared with £7,934,581 for the same month of 1950, while there was an increase of £561,270 over December.

Some notable increases revealed in the *Trade and Navigation Accounts of the United Kingdom*, January, 1951 (HMSO, 8s. 6d.) include the following: Detergents £147,536 (£18,312); fertilisers £95,904 (£26,232); sodium carbonate £264,146 (£164,870).

| | Jan., 1951 | Jan., 1950 |
|---|---|---|
| | Cwt. | Cwt. |
| Acetone | 16,751 | 15,342 |
| Citric acid | 2,073 | 3,720 |
| | Gal. | Gal. |
| Cresylic acid | 332,060 | 267,255 |
| | Cwt. | Cwt. |
| Formic acid | 3,978 | 4,447 |
| | Lb. | Lb. |
| Salicylic acid (including salicylates) | 85,164 | 166,050 |
| Value of all other sorts of acid | £115,131 | £114,755 |
| | Tons | Tons |
| Sulphate of alumina | 1,695 | 2,589 |
| All other aluminium compounds | 3,214 | 3,136 |
| Ammonium sulphate | 18,002 | 29,730 |
| Ammonium nitrate | 7,413 | 4,535 |
| All other sorts of ammonium compounds | 2,358 | 1,868 |
| | Gal. | Gal. |
| Benzol | 122,286 | 830 |
| | Cwt. | Cwt. |
| Bleaching powder | 25,479 | 24,233 |
| All other bleaching materials | 8,994 | 8,537 |
| Calcium Carbide | 7,379 | 15,950 |
| Cobalt compounds | 805 | 838 |
| Collodion cotton | 2,868 | 1,889 |
| | Tons | Tons |
| Copper sulphate | 3,803 | 2,046 |
| | Cwt. | Cwt. |
| Detergents (synthetic organic) and soap substitutes | 22,473 | 4,122 |
| Disinfectants, insecticides, etc. | 42,023 | 29,404 |
| | Tons | Tons |
| Fertilisers | 6,261 | 2,101 |
| Value of gases (compressed, liquefied or solidified) | £34,990 | £26,336 |
| | Cwt. | Cwt. |
| Lead acetate, litharge, red lead, etc. | 10,318 | 8,043 |
| | Gal. | Gal. |
| Tetra-ethyl lead | 88,511 | 131,130 |
| | Tons | Tons |
| Magnesium compounds | 987 | 1,028 |
| | Cwt. | Cwt. |
| Nickel salts | 5,302 | 6,250 |
| Potassium compounds | 7,852 | 5,385 |
| | Tons | Tons |
| Salt | 23,848 | 21,776 |
| | Cwt. | Cwt. |
| Sodium carbonate | 471,212 | 275,399 |
| Caustic soda | 133,008 | 252,357 |
| Sodium silicate | 35,533 | 19,293 |
| Sodium sulphate | 16,267 | 73,785 |
| All other sodium compounds | 101,025 | 75,153 |
| | Gal. | Gal. |
| Tar, creosote, anthracene oils | 1,369,861 | 2,781,273 |
| | Tons | Tons |
| Zinc oxide | 104 | 827 |
| Total value of chemical manufactures (excluding drugs and dyestuffs) | £5,374,182 | £4,308,214 |
| Value of quinine and quinine salts | £50,130 | £43,738 |
| | 100 I.U. | 100 I.U. |
| Insulin | 1,166,789 | 1,208,017 |
| | Mega Units | Mega Units |
| Penicillin | 1,368,778 | 1,018,497 |
| Total value of drugs, medicines, and preparations | £2,680,005 | £1,756,256 |
| Total value of dyes and dyestuffs | £901,082 | £746,999 |
| Total value of paints, pigments, colours and extenders | £1,460,724 | £1,123,212 |
| Total value of group (chemicals, drugs, dyes and colours) | £10,415,993 | £7,934,581 |
| | Cwt. | Cwt. |
| Plastic materials | 89,722 | 52,235 |
| Value of all plastic materials | £1,248,129 | £657,205 |
| | Cwt. | Cwt. |
| Chemical glassware | 1,689 | 1,490 |
| Value | £67,429 | £57,105 |
| | Cwt. | Cwt. |
| Fans | 6,596 | 5,180 |
| Value | £141,175 | £178,378 |
| | Cwt. | Cwt. |
| Furnace plant | 11,558 | 6,161 |
| Value | £110,102 | £111,043 |
| | Cwt. | Cwt. |
| Gas and chemical machinery | 16,503 | 32,135 |
| Value | £223,237 | £380,508 |
| Value of scientific instruments (optical) | £80,059 | £81,665 |
| Value of thermometers, mercury-in-glass instruments, etc. | £50,250 | £34,327 |
| | Cwt. | Cwt. |
| Air and gas compressors and exhausters | 18 546 | 20,427 |
| Value | £391,221 | £413,886 |
| **Non-ferrous metals—** | | |
| Aluminium and aluminium alloys | Cwt. 135,241 | Cwt. 85,946 |
| Value | £1,699,186 | £1,048,053 |
| | Lb. | Lb. |
| Bismuth metal | 7,510 | 22,396 |
| Value | £6,354 | £16,614 |
| Brass and other alloys of copper | Cwt. 105,660 | Cwt. 124,250 |
| Value | £1,544,942 | £1,150,188 |
| | Tons | Tons |
| Copper | 3,796 | 3,774 |
| Value | £1,062,028 | £817,905 |
| | Tons | Tons |
| Lead, sheets, etc. | 699 | 288 |
| Value | £121,615 | £42,135 |
| | Cwt. | Cwt. |
| Nickel and manufactures | 13,925 | 21,047 |
| Value | £301,766 | £338,412 |
| | Cwt. | Cwt. |
| Nickel alloys | 3,535 | 3,660 |
| Value | £103,551 | £68,474 |
| | Tons | Tons |
| Tin, unwrought | 521 | 471 |
| Value | £565,811 | £296,627 |
| | Lb. | Lb. |
| Tungsten (except ferro-tungsten) | 46,396 | 17,109 |
| Value | £35,050 | £14,950 |
| | Tons | Tons |
| Zinc | 501 | 605 |
| Value | £101,134 | £80,042 |
| Total value of group | £7,567,886 | £6,004,253 |

# Metallurgical Section

3 March 1951

## *Developing Hungary's Aluminium Industry*

### *New Factory the Largest in Europe*

By GYÖRGY DOBOS

THE new alumina factory at Almásfüzitö means a decisive change in character of the Hungarian aluminium industry. From now on more than half of Hungarian bauxite production will be turned to aluminium in Hungary itself. Before the war nearly the entire bauxite output was exported and only 3-4 per cent was used in Hungarian factories.

The alumina factory in Almásfüzitö is constructed on the classical Bayer principle. The works are connected by an industrial railway to Almásfüzitö Railway Station. The siting of the factory and the process to be used were determined by the following factors:—

1. Situation and quality of the bauxite deposits.
2. Availability of coal.
3. The presence of water of suitable quantity and quality.

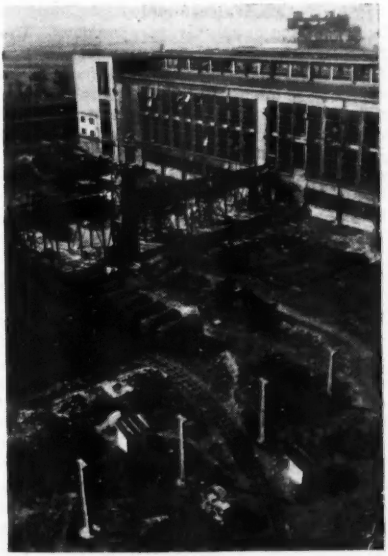
It would be ideal if all three factors were found at the same place. As a rule this does not occur in Hungary. From the point of view of location, therefore, a place had to be found where a suitable quantity and quality of water were available and which was at the minimum distance from bauxite and coal deposits. For these reasons Almásfüzitö was chosen. As the bauxite used come from deposits at Iskaszentgyörgy, certain deposits on the usual Bayer process had to be carried out.

**Considerable Expansion**

The size of the new factory considerably surpasses the other two factories operating in Hungary and an expansion to nearly twice the present capacity is allowed for. With its present capacity the factory is one of the largest in Europe, and when the expansions are carried out, it will be the largest.

The bauxite from the Iskaszentgyörgy deposits is a trihydrate and also possess other physical characteristics which make it different from all other bauxites, necessitating alterations in the classical Bayer process. The two alumina factories in operation are not suitable for working up Iskaszentgyörgy bauxite. Pilot plant experiments have shown that sedimentation of the sludge, which is one of the most important operations in producing pure $Al_2O_3$, cannot be carried out easily.

The following are the main units in the Almásfüzitö factory: power station; installation for the production of gas; pumping



*The Hungarian alumina factory at Almásfüzitö showing the bridge under construction connecting the mixing plant with the bauxite processing plant*

stations for water supply; the alumina factory proper.

The power station supplies the entire steam and energy needs of the factory and will also furnish energy to the national grid. The boilers are built for the use of low-grade coal, are of medium pressure and have a modern slag delivery equipment.

The turbines are of the counter-pressure system and are equipped for immediate steam delivery. The autoclaves receive the necessary steam from the turbines for the solution of the ore. The tired steam is used for the evaporating installations and then led back into the boilers as condensed water. The current generated is more than is necessary for the production of alumina and the difference can be used for other purposes.

The gas equipment consists of Koller system generators. The crude gas is purified through tar and oil separators and gas of great purity is obtained. The tar and oils obtained as by-products find their industrial applications elsewhere.

**Water Supply**

The water supply is very modern. The necessary quantity of water passes through a gravel pre-filter and then through pipes into the pumping station when, after suitable preparation, it reaches the boilers, and the cooling system of the evaporators. It is of great advantage that the Danube has a relatively low temperature even in the summer, and thus the cooling water of the evaporators can be kept nearly constant, which is very important.

The bauxite arriving from the mines contains about 17-20 per cent loose humidity. With the help of cranes it is piled into high bunkers several stories high. Underneath are the crushing machines, and the bauxite passes from the top downwards. It is crushed in several grades and finally delivered into the stores.

The bunkers are unique in their kind as their dimensions and the internal transporting equipments result in perfect storage.

The pre-crushed bauxite is either delivered into bunkers where it is kept till further processing or sent straight through feeding machines into the stationary furnaces. The furnaces are essentially the same as used for the roasting of iron ores (pyrite) and consist of high cylinders with several floors. The material is propelled into rotating cylinders in such a way that it falls through apertures on to the next floor. The furnaces are heated by gas flowing in a contrary direction to the bauxite. The uniform heat throughout the furnace and the slow passage of the particles ensures the uniform heating of the whole mass of particles. Consequently, the entire surface water and part of the crystal water is removed from each particle in equal percentage ratio and drying is throughout uniform for particles of different sizes.

The dried bauxite is carried on conveyor belts to pipe mills in which it is ground to a fine powder. Sieves in the mill separate the different particle sizes and the fine powder is then stored. The bauxite powder is then weighed and transported to the mixing vessels where it is mixed with previously weighed quantities of caustic soda. The mixture is pumped into autoclaves which have internal heating spirals. After suitable heating, the reaction between the aluminium oxide of the bauxite and caustic soda takes place.

The reaction completed, the pressure of the autoclave pumps the sludge into the diluting vessels. After suitable dilution the sludge is now transferred into Dorr-type sedimentation towers several stories high. The towers have five floors and fitted with slow-motion stirrers which push the sludge along. After sedimentation, the clear sodium aluminate solution is pumped into the so-called mixing vessels.

**Caustic Soda Regained**

The sediment from the Dorr towers is filtered and washed through Kelly-type filters. In order to regain the large quantities of caustic soda contained in the sludge, suitable concentrations of lime sludges are added. Two-thirds of the caustic soda is regained in this way and the production costs of the alumina are thus considerably lowered.

The sediment, which contains lime and iron, is worked up in iron smelting works.

The pure sodium aluminate solution is cooled through three Kröting-type coolers and the aluminium hydroxide then separated. The precipitated aluminium hydroxide is pumped on to the hydro-separators which separates the aluminium hydroxides of different particle size.

The hydroseparators are, like the Dorr towers, very large vessels fitted with stirrers. The slow-motion stirrers separate the heavier sludge from the lighter and promotes sedimentation. The lighter

sludge returns to the mixing vessels where it helps the precipitation of the sodium-aluminate and the heavier sludge is transferred to one of the double Imperial-type filters.

The rotating drum filters wash and dry the precipitate, which is then either conveyed into the hydrate stores or into one of the calcining drums.

The calcining drums are lined with chamotte, rotate and are fitted with recuperating pipes. They are heated by gas to nearly 1,300°C. The hydroxide loses all its adherent and constitutional water and leaves the drums as alumina. In the recuperating pipes the alumina is air cooled, and the heated air is then used for heating.

The caustic sodium solution on leaving the Imperial filters are concentrated in Vogelbusch-type concentrating vessels. Here the caustic soda solution is brought to a concentration required in the autoclave process. Four Vogelbusch vessels form one battery, each fitted with a vacuum pump.

The red sludge containing lime will be conveyed to a lake of one million cubic metre capacity.

## Attractive Characteristics

### *Titanium Alloys Future Importance*

AT a joint meeting of the American Society for Testing Materials and American Society of Mechanical Engineers, N. E. Promisel discussed titanium alloys and their potential applications and outlined their salient attractive characteristics as follows:—

1. Low specific gravity.
2. High strength.
3. Retention of strength at intermediate temperatures.
4. Attractive modulus of elasticity.
5. Adaptability to surface hardening.
6. General resistance to environment attack.
7. High melting point.
8. Abundant availability of ore.

This is such a unique combination of properties, that although it is difficult to forecast in specific detail its future application, there is no hazard at all in predicting such an extensive and important future for this material that one is tempted to resort to terms which have been applied to this metal, such as wonder-metal, and so on.

Potential applications for titanium may be divided into the major categories of industrial and military. By compiling relative costs of common metals, it is evident that for some time titanium will be used in quantity in industry only where no other material is suitable, or where other materials are so poorly adaptable that excessive maintenance, replacement or hazard justifies the extra expenditure, or where the quantity of material needed in each individual case is small, or where the cost of material is but a small part of the total manufacturing cost. For example, there are corrosion problems in industrial processing and transportation where the extra cost may well be justified. The storage and shipment of fuming nitric acid may be such a case. In the laboratory, special equipment or replacement for precious or rare metals might be made of titanium.

**Advantages to Industry**

The electrical industry may be able to take advantage of high resistivity in some alloys or other unique electrical properties. Industrial equipment operating at high rates of speed, requiring lightness of parts and wear resistant surfaces, as in the textile industry, may find ready and advantageous use even at this time. But the development of extensive uses in industry seems likely to be fairly slow and will obviously be geared closely to the price level of the material.

The military picture is altogether different. There are already so many clear cut uses for titanium and its alloys that the major problem is already one of being able to produce the required quantities in the required time. Here mobility and transportability are to a great extent determined by weight, and one of the major features of titanium is that it is the only reasonable light metal developed to-date which does not lose strength rapidly at temperatures up to about 800°F. Thus an important and fast-increasing number of applications has arisen in aircraft.

Yet there are still some deficiencies in this so called 'Wonder Metal.' There is room for improvement, for example, in anti-galling and wear properties and notch-sensitivity. Much must be learned about its fabrication properties. The process for producing it must be made more economical and practical. Casting methods must be developed. The problem of scrap disposal is still with us. But all in all, never in the history of metals has a single material offered so much in such a short time.

# *Atomic Energy Progress*

**Reactor Developments by AEC.**

ADVANCED work on an experimental breeder reactor which will not only test the feasibility of creating nuclear fuel faster than it is consumed, but will also create a small amount of power, is recorded in the ninth semi-annual report to Congress of the U.S. Atomic Energy Commission.

Uranium remains the primary atomic raw material. It occurs naturally in two forms: fissionable uranium-235, which can be used as an atomic fuel, and non-fissionable uranium-238. Experiments have shown, however, that thorium, which is a far more plentiful metal, can be transmuted by neutron bombardment into uranium-233, which is also fissionable.

Work is progressing on the development of a land-based prototype submarine thermal reactor, which will utilise slow neutrons. The project is being carried out by the commission's Argonne National Laboratory in Chicago, Illinois, and the Westinghouse Electric Corporation with the ultimate aim of harnessing nuclear energy for industrial power production.

### Radiation Protection

Protection of human beings against the effects of atomic radiation have been the subject of investigation by the AEC. A number of tests have been made on laboratory animals and it is considered that these might be adapted to methods which might enable humans to survive radiation exposure previously thought to be fatal.

These investigations showed that cysteine, a constituent of proteins, increased an animal's chances of surviving heavy doses of radiation; by shielding the spleen an animal's resistance to radiation was about doubled; and animals deprived of oxygen at the moment of exposure to radiation were more likely to survive than those which received plenty of oxygen.

In physical research the AEC report included the discovery of two new elements, berkelium (No. 97) and californium (No. 98), both at the University of California, where the acceleration of carbon atoms in cyclotrons to speeds equivalent to 100 million volts was achieved.

In the biological and medical sciences, progress was reported in studies with radioactive effects on cancer, hyperthyroidism, genetics, and fertilisers. Investigations are continuing on the use of radioactive gallium in the treatment of bone cancer, radioactive ruthenium for surface tumours, and radioactive manganese for thyroid tumours. Means have been perfected for treating deep-seated cancers with radioactive cobalt equal in power to 'two-thirds of the world's known supply of refined radium.'

Radio-cobalt-nylon thread is being used to treat tumours. Nylon tubing is sewn in the tissues to be treated and radiocobalt is then inserted to provide a source of radiation. Radioactive iodine, it has been learned is effective in certain cases of heart disease marked by chest pains and fainting.

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# *Deposits of Rare Minerals*

VALUABLE deposits of rare minerals newy discovered in Southern California by geological survey may enable the United States to become largely self-sufficient in these elements, said Oscar L. Chapman, Secretary of the Interior, recently. The new finds are in San Bernardino County, near the Mountain Pass service station, 35 miles east of Baker, California, on Highway 91.

A vein of rare earth was originally discovered in this area in 1949 on the so-called 'birthday claims,' and intensive studies of the area were begun shortly afterwards by the geological survey. These studies indicate that an area roughly six miles long and two miles wide, extending south-east from the original discovery, contains numerous deposits of rare earths, chiefly cerium, lanthanum, neodymium, and praseodymium. The full size and extent of these deposits are still not known, but some of them appear to be very large and it is estimated that a single deposit in the area, if it extends to a depth of 100 feet, may contain 50,000 tons of rare earth bearing minerals.

The chief rare earth mineral in the deposits is bastnaesite, a fluorcarbonate of the cerium earths, constituting about 65 per cent of the mineral, together with variable quantities of thorium. Most important of the new discoveries are several bodies of barite-bastnaesite rock that appear to contain from 10 to 40 per cent of cerium earths.

Low grade nickel deposits near Riddle, Oregon, in the southern part of the state, are also being reopened by the M.A. Hanna Company of Cleveland.

# Non-Ferrous Metals Industry

## Vital Role in Britain's National Economy

THE importance of the non-ferrous metal industry to our national economy and the problem of raw material supplies are matters which call not only for immediate attention but for a long-term policy. The present rearmament and stockpiling programmes have brought a belated realisation of the seriousness of the position to many, but there are still large numbers who do not know the true situation.

*The Financial Times* of 26 February, however, contained two excellent articles which should help reduce this number. The first article was by Mr. W. H. Henman, president of the British Non-Ferrous Metals Federation, and was titled 'A Vital Basic Industry.' The second, 'Anxiety Over Raw Material Supplies,' was by Mr. H. E. Jackson, vice-president of the Federation.

Mr. Henman's article was as follows:—

The present shortage of copper, zinc, nickel and other non-ferrous metals, and the steps which have been taken by the Government in limiting supplies and prohibiting certain end-uses, have focused public attention upon the non-ferrous metals fabricating industry.

This is a basic industry of comparatively small size when compared to iron and steel, but of vital importance to our national economy, both in peace time and even more in war time. The raw material of the industry consists principally of copper and zinc, with nickel as a good third, lead, tin and other non-ferrous metals being used in small quantities as alloying materials.

The two major metals, copper and zinc, are available to manufacturers from one source only, namely, the Ministry of Supply, which operates a bulk-purchasing programme on behalf of the Government and which controls both the quantity sold to manufacturers and the price to be paid.

The fabricating industry in Great Britain receives the different metals in the form of ingot, slab, billet, wirebar, etc., and converts them into the commercial form of sheet, strip, tube, wire, rod, etc., either in unalloyed copper or in the desired alloy, such as the different qualities of brass, bronze gilding metal, nickel silver, cupro-nickel, etc.

The total output of the industry in all forms amounts to about 550,000 tons a year, of which approximately 300,000 tons is in the form of unalloyed copper and the balance in the form of alloys. The turnover of the industry amounts to about £125,000,000 a year, which is very largely absorbed by the cost of raw material. Conversion margins throughout the whole industry are very low.

The industry presents a picture of great diversity and every type of producer can be found. There are large concerns which cover the whole range of production and produce every type of semi-finished product in all the major lines.

Although constant efforts are being made towards standardisation and simplification, it remains broadly true that the industry is a bespoke trade. There are a number of standard lines and from time to time manufacturers have been able in the past to make these for stock and to give immediate delivery. In general, however, and certainly since the recent restrictions on material supplies, all business is done to order to the specific requirements of the customer.

The total number of fabricating firms in the country is comparatively small, being in the neighbourhood of one hundred. At one time the industry was almost exclusively associated with Birmingham and the Midlands, and this district still remains the heart and centre of the fabricating trade, although during the last 50 years centres have also grown up in London, South Wales, Scotland, Yorkshire and the North-East, and elsewhere.

The pressure of events during the war, and the necessity to form a central body which could represent the common views of all sections of the industry and could provide common services, led to the formation in 1945 of the British Non-Ferrous Metals Federation, which groups together 11 trade associations. Federated firms are together responsible for approximately 83 per cent of the country's total production of fabricated products.

The foresight of those who under Dr. Horace W. Clarke (its first president) sponsored the formation of the Federation has been abundantly justified. This organisation has filled a need both in the fabricating industry and in the general economic

structure of the country. As the organ of consultation between the industry and the Ministry of Supply, as well as international bodies like O.E.E.C., and as the opposite number to the trade organisations of consuming industries, the Federation has a rôle of growing importance.

### Lack of Official Guidance

The end-uses of non-ferrous metal products are extremely various. Some of the main consumer industries are cables, electrical engineering, motor vehicles and aircraft and all forms of engineering, while there is a very substantial demand both for tubes and sheet for housing and construction purposes. The Government's recent Statutory Orders have appeared to emphasise the importance of some uses of non-ferrous metals, which, in fact, consume a very small proportion of the total.

It is perhaps appropriate that I, as the president of the British Non-Ferrous Metals Federation, should take this opportunity of warning consuming industries that at the present level of raw material supplies, even the total suppression of every use of metal contained in the Prohibition Orders will still leave a substantial gap between the demands of industry both for rearmament and for civil purposes and the output which manufacturers will be able to produce from their very limited allocations of copper, zinc and nickel.

So far the industry has received guidance only in the most general terms as to how this gap is to be bridged.

The Federation has, however, established, in conjunction with the Ministry of Supply, its internal machinery for ensuring that so far as possible, within the limitations of raw material, the more essential requirements of productive industry are satisfied.

Although there has been some limitation on supplies in force for several months, the restrictions have, of course, become much more serious since 1 January and it is only now that their effect is becoming evident. It would, unfortunately, be over-optimistic to assume that the full effect of shortages has yet been felt.

The immediate future of the non-ferrous metals fabricating industry and, therefore, of all their customers depends upon two factors. First, can the Ministry of Supply, through its own activity, or through the machinery of the various international organisations which are concerned with scarce materials, provide adequate supplies of raw materials to keep the mills going? Secondly, what will be the relation of the rearmament programme to civilian demand over the next 12 months or so?

The nature of the demand for rearmament is of equal importance with its magnitude. The production programme, for example, for vast quantities of ammunition strip, is very different from that for small and complicated components, although both may be produced by the same fabricator.

The time factor is also extremely important. The immediate requirement seems to be that the Government should accelerate the placing of their detailed requirements, particularly for sub-contracts, in order to provide work for a number of the finished producers who will be hard hit by the Prohibition Orders.

In this way the fabricators will be able to keep their production schedules going and we shall avoid the danger of losing skilled labour during the interim period, which might be extremely difficult to replace when it is urgently required at a time of full rearmament.

### Policy Awaited

As these words are being written, the industry is still awaiting a declaration of the Government policy for the export of non-ferrous metal and semi-finished products. Although the conversion margin on many of these products is comparatively small and they do not from this point of view represent a very valuable item in the national trade balance, it is undoubtedly true that since the war and with the disappearance of some of the big European producers, the British Commonwealth, together with a number of Western European countries, have become increasingly dependent upon the British non-ferrous metals industry for their essential supplies.

It would, therefore, not be surprising if the Government were to take the view that this country has a moral obligation to continue the export of at least a token quantity of non-ferrous metals products even at some cost to ourselves.

Recent statements by the Prime Minister and the Chancellor of the Exchequer have clearly indicated that British manufacturers who are making for export and who require non-ferrous material will continue to get a high priority.

The immediate outlook therefore is that the industry is in a healthy condition and has ample productive capacity. Owing to the world shortage of raw materials there are abundant orders open both at home and abroad, and there is a far greater demand than can at present be satisfied.

The following is an abstract from Mr. Jackson's article:—

Not once but many times during the past few years the nation has been told that it must export to live. While overseas business in brass and copper products has been sizeable and has made a useful contribution to the total, it is to the import side that the eyes of the industry must always be turned; for, in truth, without a steady flow of metal from abroad our trade would languish and eventually perish.

Apart from small quantities of lead and tin mined in the United Kingdom, our home production of ores is nil. Practically all our supplies of non-ferrous metals, whether in the form of metal or concentrates, come to this country from distances of thousands of miles. But there are, of course, important and active plants whose output of zinc and lead from imported ores and concentrates runs into thousands of tons annually and without which our metal budget would be even more unbalanced than it is.

### Tin and Nickel Plant

In addition, we have the tin smelting industry and the plant at Clydach in South Wales producing nickel. From a comparatively small beginning, the output of copper cathodes in Britain is building up month by month to a level which is beginning to assume quite important dimensions. This is, of course, apart from the well-established activities of plants engaged in making fire refined ingot cakes and wirebars. These refineries operate almost entirely on the basis of copper scrap arising within the confines of the United Kingdom and imported blister copper.

From this cursory survey of the supply situation, let me turn to some of the problems which arise from the fact of our dependence upon the outside world.

An empty metal larder is a tragic and dangerous affair. Of prime importance, therefore, is the maintenance of a safety stock level, whether it be held by consumers on consignment or by the Government as a strategic stockpile. And it follows that if these essential reserves are to be maintained in being, forward planning by the smelters and refineries is essential, the programme being based on information furnished by the consumers.

### Problem of Valuation

Another problem attaching to external lines of supply is that of price. Served as we are and always have been by diverse areas, each with its own currency and trading arrangements, how are the conflicting valuations of the metals to be resolved?

As a country not blessed with indigenous supplies, and therefore at the mercy, as it were, of the overseas producers, Britain could hardly be more happy than if she were in a position year in and year out to maintain a register in sterling of the prices at which she is prepared to do business.

This system of valuation, provided it is acceptable to the producers, is as near ideal as anything can be in an imperfect world, and in the operation of the London Metal Exchange before the war and for many years back we had this very plan in successful operation. Britain did in fact possess the most influential yardstick of non-ferrous metal values in the world and the existence of the market in Whittington Avenue, with its facilities for trading futures and opportunities for hedging, was of the very greatest help to the fabricating industries as well as of enduring value to the country's economy by virtue of earnings in the shape of invisible exports.

It is perhaps hardly necessary, when so much well-documented evidence relating to our trade is available, to enumerate in detail the sources of supply of the various metals. It is sufficient to emphasise Britain's good fortune in the fact that a not inconsiderable proportion of the known reserves of the non-ferrous metals is situated in the Commonwealth countries.

The question of duration of supplies is, however, vital to the future of the non-ferrous industry and is something in which every metal user should interest himself. Elimination of wasteful operations in manufacturing, coupled with the maintenance of the highest efficiency in recovery of metals from residues, etc., are matters which must be kept constantly before us on the basis of today's prices. The future, it is obvious, is going to be fraught with difficulty and uncertainty.

# *Metals Present in Nature*

## *Improved Methods of Colorimetric Analysis*

NEW techniques for the determination of zinc, lead, vanadium and chromium, as they occur in their natural state, have been put forward recently by Mr. Yukio Murakami, of the Chemical Society of Japan.

Diethyldithiocarbamate, introduced originally as a reagent for the estimation of copper, is recommended by Mr. Murakami for the estimation of zinc and lead in natural waters. In the case of zinc, he claims that this reagent is as delicate as ferrocyanide and better than resorcinol, since it does not react with alkalis or alkaline earths, although iron causes a yellow turbidity when present to excess and must be removed. (Better than its removal is the use of sodium pyrophosphate to prevent its precipitation). Manganese turns the solution slightly pink due to atmospheric oxidation, but this colour is unstable; nickel, cobalt and bismuth also interfere, but these elements are rarely found in natural water.

### Experimental Determination

The determination of zinc is carried out best at 20° C., and *p*H 4.8, buffered with ammonia and acetic acid. It is interesting to note that the higher the *p*H, the less turbidity is formed, with the result that excess ammonia removes the turbidity nearly completely, a valuable device when time is short for determining zinc in the presence of lead, whose turbidity is not affected by a change in *p*H.

With lead, diethyldithiocarbamate has several advantages over other methods, principally the stable turbidity produced which is easily extractable with ether and stable to oxidation. As such it is the most suitable reagent for the estimation of lead in excreta and tissue, even though zinc, copper and iron must be removed first. These are best separated with dithizone, removing the copper from the others with hydrochloric acid, when zinc and lead go into solution as chlorides, and can be separated with more dithizone in the presence of KCNS or, more quickly, by increasing the *p*H as mentioned above, and using an empirical standard curve to obtain the true values for the concentration.

For the estimation of vanadium in the presence of a large amount of iron, as in silicate rocks, Mr. Murakami recommends separation of the element from the carbonate melt by leaching with water; filtration and reduction of the manganate with alcohol; treatment with oxine after neutralisation with sulphuric acid (to methyl orange), and extraction with chloroform. The extract is then evaporated, the residue fused with sodium carbonate to convert the element to vanadate, and the vanadate determined colorimetrically as vanadophosphotungstic acid.

Excess iron interferes badly with this determination however, ferric iron by combining with the oxine, and ferrous by reducing the vanadate ion to a vanadyl ion, which does not react with the oxine at all (the latter error being the more serious). Ferric iron interference can be removed to some extent by heating, and the effect of ferrous iron can be nullified by treatment with just enough permanganate to ensure that all the vanadium is present as vanadate, but complete removal of the iron is preferable. This is best done in an alkaline medium with oxine (when only iron reacts), and subsequent extraction with chloroform. Almost complete separation is accomplished by this method, and as little as 0.001 per cent of vanadium can be detected.

### Estimation of Chromium

The determination of chromium in coal ash, muds and silicate rocks with diphenylcarbazide, writes Mr. Murakami, has been found previously to give low results. This he attributes to the reduction to the chromic state of the sexavalent chromium ion formed

[*continued at foot of page* 357

# Model Distillation

## Mechanical Analogue for Separation Processes

AN interesting idea was put forward to the North-Western Branch of the Institution of Chemical Engineers, at its meeting in Leeds on 17 February, by Mr. J. S. Forsyth, Ph.D., in conjunction with Mr. N. L. Franklin, M.Sc., and Mr. H. Winning, all of Leeds University. This was the suggestion that for the solution of the many problems involved in the process of distillation and other means of separation, a mechanical analogue, or model, of the process should be constructed, and instead of performing a laborious analysis of the various fractions of liquid or vapour concerned, the answer should be read off quickly and accurately from the model.

Dr. Forsyth took for his example, a distillation process involving five components, because its technique was well understood. The principle of the model, he said, rested on the substitution of steel balls of various sizes for each component in the mixture, the higher being the volatility of the component, the larger the ball, and the higher being the molal concentration, the greater the number of balls. The model on view consisted of a self-contained plate unit, representing one stage of fractionation, which performed operations exactly analagous to those of one plate of a fractionating column.

The stream of balls representing liquid or vapour passing any point, said Dr. Forsyth, was analogous to the concentration of liquid or vapour flowing past that point. The plate consisted of four basic units; the volatility unit, which provided a means of finding the vapour in equilibrium with any given liquid; the reflux unit to measure correct quantities of liquid and of vapour and dispatch them to the preceding and subsequent plates; the sizing unit to separate the mixture of balls into their component sizes and deliver the separated stream to the volatility unit; and the elevator unit which was a purely mechanical device required to propel the balls between various units at a suitable stage in the process. Of these the volatility and reflux units were most closely analogous to the operations of a real fractionating column, while the sizing and elevator units were essential only to the mechanical functioning of the analogue plate.

Dr. Forsyth then described the mechanical construction of the units and gave notes on how to operate the analogue for continuous distillation with multi-feed and side streams. During the course of the paper, he also gave a calculation to show that, although a 90 per cent concentration of the top product could appear on the top plate, the proportions of the two other higher-boiling components of the three-component mixture would be unknown.

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## Metals Present in Nature

*continued from page 356*

during the carbonate fusion, either by the alcohol used to reduce the manganate, or by ferrous iron (as in the vanadate determination), or by the contact of oxine and chloroform necessary to remove the vanadium, or even by the filter paper used to remove the last droplets of chloroform. Many of these reasons, he points out, have been ignored in previous work, due to negative results in the experiments concerned. Ferrous iron, once more, is the chief offender, due to the peptisation of hydrous ferric oxide by the silica, but vanadium also interferes by darkening the colour of the chromate, and is best removed with oxine.

For these reasons Mr. Murakami asserts, it is very necessary to keep the chromium ion in the sexavalent state if any accuracy is required in the determination. The best method, the author has discovered, is oxidation of the solution with alkaline sodium peroxide after the vanadium has been extracted. Since the subsequent acidification would cause any excess peroxide to reduce the chromate ion again, the peroxide must be removed completely before acid is added. Boiling, followed by the addition of impurity-free manganese dioxide and filtration achieves this completely, and the results obtained by this method show a great improvement on previous experiments.

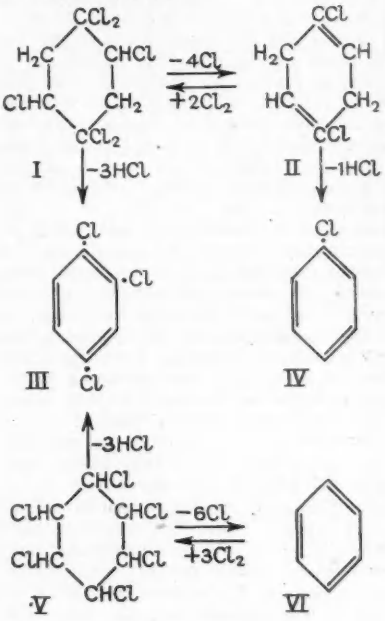
# Hexachloro-Cyclohexane

RIEMSCHNEIDER and collaborators, of the University of Berlin, have described in four informations (*Zeitschrift für Naturforschung* 1950, 5, 6, and 7) the production, constitution and chemical properties of the hexachloro-cyclohexanes which former authors characterised as zeta-isomers. The so-called "zeta-hexachloro-cyclohexane," melting point 146° C., however, isolated from the chlorination of cyclohexane, cannot be considered as a stereo-isomer in the series of 1, 2, 3, 4, 5, 6,-hexachloro-cyclohexanes, but as the first representative of a new series, the α-1, 1, 2, 4, 4, 5-hexachloro-cyclohexane (1).

The presence of $CCl_2$-groups in (I) was proved by the authors under zinc powder treatment. While all the stereo-isomers of (V), when heated in methyl alcohol with zinc powder, yielded benzene (VI), the new compound (I) under the same treatment was transformed into 1,4-dichloro-cyclohexadiene (II). Against this, however, the (V)-isomers and (I) gave the same product with alcoholic caustic potash treatment. This was 1, 2, 4-trichlorobenzene (III).

Another transformation of importance in explaining the constitution of (I), was the addition of chlorine to (II) resulting in a return to (I), which showed no depression of melting point when mixed with (I) isolated from cyclohexane chlorination products. As (II) under alkaline treatment gave (IV) it can be concluded that the double links in (II) are not conjugated.

The insecticidal effect of (I) is described as a rather low one.




## 'Labelled' Insecticides

*continued from page 346*

By studying the metabolism of cells in yeast it is hoped to obtain valuable information regarding the division of cells in general, the way in which they respond to the poison, and what happens to the enzymes of the cell itself. Many of the simpler enzymes, such as those of yeast, are quite similar to those of higher animals. By studying the toxicity of methyl bromide on a fairly simple system it may thus be possible to determine the action of this fumigant on insects and animals.

For the purpose of the investigation cultures of yeast are exposed to methyl bromide. The cells are then grown in agar and the percentage killed by a given concentration of fumigant is determined by visible counting. Photoelectric methods are also being used to measure the rate of growth of yeast cells in suspension, the yeast having previously been treated with a very low concentration of methyl bromide in solution.

When these investigations are further advanced, radioactive materials will be used to trace some of the stages in the blocking of the enzyme system and find out at what stage the poison acts.

The writer is indebted to Mr. F. P. W. Winteringham, F.R.I.C., for describing the tracer-biochemical work in his charge at the Pest Infestation Laboratory.

**REFERENCES**

"The Fate of Labelled Insecticide Residues in Food Products,' *Journ. Science of Food and Agric.*, 1950, No. 7
*Nature*, 1951, *167*, 106.

# Technical Publications

SELF-WINDING electrical cable reels of the 'Wayne' design (it is claimed) are particularly suitable for operation in chemical works and factories generally.

These reels are a production of Power House Components, Ltd., King Street, Nottingham, under the direction of David Rushworth and carry the registered trade mark 'P.H.C.' The principle is similar to that of the spring roller blind, the cable being pulled out as required against the action of a spring which ensures that it is kept taut and when released winds smoothly back again, something like a clock in a metal case. This results in a great improvement in the working of electric cables of all kinds, including reduced wear and tear and maintenance costs.

In addition to the nine standard 'Wayne' reels available for ordinary use, according to the length and diameter of the cable, many specialised designs have been evolved during the past few years, of which one example that may be mentioned is the patent twin standard reel intended for use with electrically operated hand tools where it is essential to suspend the tool from an overhead position.

As regards specific applications, out of a large number that might be mentioned is the case of a chemical factory where formerly bare copper wire conductors were used, which became coated with deposits as a result of chemical dust in the atmosphere, while also a certain amount of humidity added to the difficulties. Since the replacement of the bare copper wire conductors with 'Wayne' reels, however, involving only an insulated cable, both these disadvantages have been eliminated, and in addition a much greater factor of safety has been established.

In another factory the loading bay was equipped with festooned cables on the goods hoist, until unfortunately one day a load of steel rods swung round and caught in the cable with very unpleasant results. Accordingly, it was decided to do away altogether with the festooned cable and install a 'Wayne' reel, since when, no further trouble has been experienced.

* *

DUST from concrete floors is one of the problems of modern industry. The trouble is caused by the breaking up of the soft carbonate of lime particles in concrete under heavy wear. Much research has been devoted to hardening these lime particles against 'dusting.' A recent development is Fluat cement hardener described in its latest leaflet by Tretol, Ltd. By direct chemical action the soft carbonate of lime particles are transformed into hard chemically inert crystals to form a floor surface having an increased resistance to oils and weak chemicals. The chemical action can be expressed as follows:—

$$\text{Tretol-Fluat} + \text{concrete} = 6CaFl_2 + 3MgFl_2 + 3SiO_2 + 6O_2$$

* *

RAW material shortages, their causes, and possible alleviation are concisely discussed by R. C. Todhunter in the current issue of the 'I.C.I. Magazine' (Vol. 29, No. 172). Other features include 'I.C.I. in India,' and Dr. J. Gordon Cook describes some of the unromantic, hard work behind the important discovery of potash in the Yorkshire boreholes.

* *

A WELCOME co-ordination of the viewpoints of the chemist and manufacturer is provided in a recent publication by the Royal Institute of Chemistry on microbalances. Designers of these high-precision instruments are not always fully informed about the precise needs of the microchemist using their products, and this report contains stimulating recommendations on design; corrosion-resistance; sensitivity and precision requirements (two different things); and potential sources of error. Information that will not come amiss to the operator either is an article on the maintenance and use of a microbalance. None of us is proof against the encroachments of habit on correct technique.

# The Chemist's Bookshelf

CHEMIE UND TECHNIK DER VITAMINE. By Dr. Hans Vogel and revised by Dr. Heinrich Knobloch. Stuttgart: Ferdinand Enke Verlag. 1950. Pp. VII+485. DM. 48.60.

Chemists have made a somewhat arbitrary division of the vitamins into two groups, water-soluble and fat-soluble. The present volume deals with the fat-soluble groups while a second about water-soluble vitamins is due to be published by the same authors in the autumn. The first edition of the book came out in 1940 as a short treatise on the subject; the second edition, essentially enlarged, appeared in 1942 and the present third edition, dealing with the rapidly growing science of vitamins, made the two-parts division inevitable. The rapid growth in this sphere of chemistry, especially in America and Great Britain, made a considerable reorganisation of the book necessary and its extent is best described by the fact that some 2,250 bibliographic references are inserted in the text and an addenda of 100 pages contains a complete list of international patents for fat-soluble vitamins arranged according to vitamins A, D, A and D, E. F, and K, etc., completed up-to-date with the latest research work on vitamins.

The book will serve well as an introduction into the chemistry of vitamins. It gives to chemists and technicians the fundamentals of a chemical section which is among the most difficult of organic chemistry and industry. Moreover, it also enables medical and pharmaceutical circles to make themselves acquainted with this difficult and hardly exhaustible subject, so rapidly and thoroughly developed within the last 40 years. The modern nomenclature of it began in 1915 and soon structural formulæ were established and industrial preparations were started in the United States and Great Britain. It may be mentioned that the same publishing house specialising in vitamin literature, announces the coming edition of the following books: 'Die Vitamine und ihre keinische Anwendung' by Drs. W. Stepp, J. Kühnau and H. Schroeder; 'Chem.-physikalische Vitaminbestimmungsmethoden,' by Dr. Fritz Gstirner; and 'Vitamine C und Ernährung,' by Dr. Willi Rudolph, and several others to follow.—F.N.

WHITE MINERAL OIL AND PETROLATUM. By Dr. Erich Meyer. Chemical Publishing Co. Inc., Brooklyn, N.Y. (Great Britain: Pearn, Pollinger & Higham, Ltd. Pp. 135. $4.75).

Gaps in technical literature occur because new discoveries have enlarged the field or, more rarely, because no one has plugged an existing hole. Since there is no end to the making of books, it is difficult for an author who is to cover an existing field to find any holes to plug. It is doubtful whether Dr. Meyer has succeeded in finding one. His book is a modest little work, covering the production, applications, methods of testing, shipping and handling of the two substances concerned.

One wonders, however, on reading it at whom it was aimed. It cannot be the production engineer, for the technical description of manufacture is sketchy in the extreme. Neither can it be aimed at the expert in industries which use these two products, for although the author covers quite interestingly a number of applications, he gives only scanty details of each. The chemists, moreover, will find in this book a recital of tests needed, but without sufficient details on how to perform them.

We are therefore left with the conclusion that this book is a general one skimming the subject for the edification of semi-technical folk and of more technical folk in other industries who want the broad facts without going into too much detail on the technique of manufacture, testing or utilisation. As such it is completely successful.—G.E.F.

# HOME

### Kaylene's Anniversary

Kaylene, Limited announce that they have completed their first 25 years. The business was founded by Mr. W. Arbuthnot Lane (now Sir W. Arbuthnot Lane, Bt.), on 25 February, 1926.

### Wolfram Price Up

The price of wolfram was again increased on 23 February, the new range being 635s.-650s. nominal per unit, c.i.f., compared with a previous range of 630s.-640s.

### Containers Shortage

Production of British-made chemicals is being hampered by the shortage of steel sheet. I.C.I. announced last week that output in some factories had had to be temporarily reduced because of a lack of drum containers. Difficulty was found in procuring containers for alkalis essential for the manufacture of aluminium, glass, paper, dyes and drugs.

### Applications Invited

Applications are invited for enrolment for the Sir John Cass College for the academic year 1951-52. Full-time courses and part-time day and evening courses are arranged in chemistry, physics, mathematics, botany, geology and zoology for the Intermediate Science examination and the B.Sc. General Degree of the University of London. There are full-time courses for the London Internal Special Degree in Chemistry and full-time and part-time courses for the B.Sc.(Eng.) Metallurgy Degree.

### New Titanium Dioxide Factory

Work is now well in hand on the construction of a 37-acre factory for the production of titanium dioxide pigments at Stallingborough, Lincs., for National Titanium Pigments Limited. Taylor Woodrow Construction Limited are the building and civil engineering contractors.

Essential raw materials, ilmenite from Malaya and pyrites from Cyprus, will be off-loaded into barges from the deep sea ships at either Hull or Immingham, and transported to a jetty that is to be built at Stallingborough. Coal, coming via the Yorkshire canals, will also be off-loaded on the new jetty.

### Britmag Price Increase

The Ministry of Supply announces that from 1 March, the price of Britmag (Dead-burnt Magnesia) will be increased by 10s. per ton to £14 per ton delivered consumers' works.

### Engineering Works Acquired

Apex Construction Ltd., have acquired the engineering works in Kent Road, Dartford, previously occupied by Doust and Company, Marine and General Engineers. Messrs. Porter Putt and Fletcher of Gravesend negotiated the transaction.

### Export Licensing Control

Export licences will be required on and after 3 March, 1951, for all destinations in respect of waste and worn-out cordage (paper making materials), and bags and sacks of vegetable fibre, and for some destinations for particular types of high pressure valves, compressors, blowers and fans, and sulphur burners and pyrites furnaces. Details are set out in the Export of Goods (Control) (Amendment No. 3) Order, 1951.

### Creditors To Meet

Notice has been given in pursuance of Section 293 of the Companies Act, 1948, that a meeting of the creditors of Thomson, Skinner and Hamilton Limited, scientific instrument makers and laboratory furnishers, will be held within the Chartered Accountants Hall, 220 St. Vincent Street, Glasgow, at 3 o'clock on Friday, 9 March, 1951, for the purposes specified in Sections 293 to 295 of the said Act.

### Magram Development

Progress of the new steel project at Margam was reviewed last week by M. E. H. Lever, chairman of the Steel Company of Wales. The slabbing mill came into production last November, and slabs of high quality were now being produced. It was hoped that the Abbey hot strip mill would start in about two months. This would be followed by the first of the cold reduction mills, and it was hoped in about six months to start up the continuous sheet mill and the continuous tin plate mill at Trostre two or three months later.

# · PERSONAL ·

The retirement is announced of ELLIOTT A. EVANS, M.I.Mech.E., F.R.I.C., chief chemist of the Wakefield Group of Companies. Mr. Evans joined C. C. Wakefield & Co., Ltd., in 1915 and is probably best known for his pioneer work in the use of metallic soaps in hydrocarbon oils. He has been closely allied with the various learned bodies associated with the petroleum industry, being a past president of the Institute of Petroleum and at the moment chairman of the Automotive Division of the Institute of Mechanical Engineers. His book 'Lubricating and Allied Oils,' first published in 1921 and now in its third edition, is regarded as a standard work on the subject.

Many distinguished men will receive honorary degrees at Glasgow University in June during the celebrations which will be held to mark the 500th anniversary of its foundation. Among those receiving the degree of Doctor of Laws will be:—SIR JOHN DOUGLAS COCKCROFT, formerly professor of Natural Philosophy, Cambridge University, director of the Atomic Energy Establishment, Harwell; SIR RICHARD VINE SOUTHWELL, formerly rector of the Imperial College of Science and Technology, London University; SIR VICTOR DUNN WARREN, Lord Provost of Glasgow; PROFESSOR NIELS BOHR, professor of theoretical physics, Copenhagen University; PROFESSOR HUGO RUDOLPH KRUYT, formerly professor of physical chemistry, Utrecht University; PROFESSOR LEOPOLD STEPHAN RUZICKA, professor of chemistry, Zürich University.

DR. W. E. BURCHAM, lecturer in physics at Cambridge University and a Fellow of Selwyn College, has been appointed professor of physics at Birmingham University in succession to PROFESSOR P. B. MOON. Dr. Burcham was a member of the British atomic research team in Canada during the war and has worked at the Telecommunications Centre at Malvern. At Cambridge he has been in charge of the nuclear apparatus at the Cavendish Laboratories.

The Board of Powell Duffryn Carbon Products, Ltd., announce that MR. A. W. MORRISON has been appointed a director of the company. Since joining the company, Mr. Morrison has been in charge of the expanding chemical carbon division at their works at Hayes, which manufactures the cubic heat exchanger and many other chemical appliances manufactured from carbon. He was educated at Ayr Academy and at Glasgow University, where he took his B.Sc. Degree in Applied Chemistry and obtained a Diploma in Chemical Science. After leaving the University he joined the Anglo-Iranian Oil Company in Persia as a chemical engineer, and subsequently went to Boots Pure Drug Company. From 1945 to 1948 he served as senior control officer of the Chemical Industries Branch of the Control Commission for Germany, being responsible for restarting and controlling production in the chemical and pharmaceutical industries and later being in charge of synthetic oil and ancillary production in the British zone. He is shortly visiting the United States.

MR. FREDERICK WILLIAM RICHARDSON, of 30 Queen's Park Avenue, Bournemouth, Public Analyst for the West Riding of Yorkshire since 1905, and Public Analyst and Consulting Chemist to Bradford Corporation since 1897, left £13,619 (£13,498 net). He left all his tobacco literature, books, and leaflets to J. Phillips, of the National Society for Non-smokers. Mr. Richardson never smoked and lived to be 90.

## OBITUARY

MR. ADAM WILSON, who was chairman of the Nobel Division (then the Explosives Division) of Imperial Chemical Industries, Ltd., from 1942 to 1945, died suddenly in Edinburgh on 15 February. Born in Stevenston, Ayrshire, in 1882, he had a distinguished career in the explosives industry of Britain which extended over more than half a century. He joined the Ardeer factory of Nobel's Explosives Co., Ltd., in 1894, becoming chief draughtsman in 1914, and in 1931 he was made group chief engineer and joined the board of the Explosives Division as delegate director. During the Second World War, Mr. Wilson was responsible for the design and building of many Ministry of Supply factories and was awarded a C.B.E. for his services.

# OVERSEAS

### Recovery of Used Oil

A factory for the refining of used lubricating oil is being erected at Lydda, Israel, and it is expected that in this way the country may save some 300 tons of lubricating oil per year.

### Iodine Made Harmless

The development of a new drug said to make iodine harmless for human beings to take, while retaining its germ-killing qualities, has been announced in New York. The drug contains polyvinylpyrolidone, derived from ecetylene.

### Canadian Aluminium Production

A giant project for the production of aluminium in the Province of British Columbia has reached the stage where an agreement has been signed between the Province and the Aluminium Company of Canada covering the terms under which this development could be undertaken. The proposal scheme would entail the development of 1½ million horsepower making possible production of over 500,000 tons aluminium a year. The marketing of this potential aluminium in the United States will have to be assured before a definitive decision is arrived at, and it is still uncertain whether the company and the United States Government will enter into a definite contract.

### New Blood Plasma

A new substitute for blood plasma, differing from one derived from okra recently reported by the Marquette University at Milwaukee, Wisconsin, is announced by the General Aniline and Film Corporation. Called PVP (for poly-vinyl-pyrrolidone), the new plasma substitute is a synthetic chemical compound from certain protein substances and acetylene gas. It is said to have unusual properties when combined with certain drugs, as for example, with iodine, which, say scientists, is not toxic when combined with PVP and can be taken internally and even be injected into the bloodstream. PVP can also be used in combination with drugs like penicillin, its makers say. Such use enables the drugs to be retained in the human system longer than when used alone. It is also said to accomplish many of the effects of real plasma.

### Peru Surveys Iron Ore

The Marcona iron-ore deposits in Peru are to be surveyed. An allocation of 1,000,000 soles for the purpose has been made in this year's budget.

### Paper from Sugar Cane

A United States group is considering the establishment of a paper mill in Brazil which would use bagasse (sugar-cane residue) as raw material.

### Dechema Rehoused

The reconstruction of Dechema house in Frankfurt am Main, at 25 Rheingau-Allee, has progressed so far that Dechema, the German manufacturers of chemical apparatus, will be able to take up their work there on 1 March. Also transferring there are the branch offices of the technical committees for the standardisation of chemical plant and laboratory apparatus.

### Safety Clothing Developed

Special clothing which protects workers against injurious chemicals has been developed by the Standard Safety Equipment Company in Chicago. The clothing, coated with a Goodrich Company product called geon resin, is said to hold off the action of inorganic acids, alkalis, salts, hydrocarbons, amines and strong oxidising agents long enough for the worker to wash and change.

### New Cortisone Synthesis

The culmination of four years research at the Mayo Foundation, Rochester, Minnesota, has resulted in a new method of preparing the 'wonder-drug' cortisone, which promises to be of no little significance in simplifying its manufacture. Previously the difficulty in synthesising cortisone lay in the fact that the compound derived from pregnane (a cattle bile extract) from which the synthesis started, had to have a single hydroxyl group inserted on its 17th carbon atom, and no reagent would do this selectively except osmium tetroxide. This substance is not only very rare and expensive, but also volatile and highly dangerous, causing partial blindness by plating the eyeballs. The new method obviates its use and should enable the drug to be made more cheaply and abundantly than before.

# Next Week's Events

MONDAY 5 MARCH

**Society of Chemical Industry**

London: School of Hygiene and Tropical Medicine, Keppall Street, W.C.1, 6.30 p.m. W. B. Emery: 'Properties, Production and Uses of Streptomycin.'

**Oil and Colour Chemists' Association**

Hull: Royal Station Hotel, 7 p.m. D. Ormeston: 'Heat Transfer.'

**Pharmaceutical Society of Great Britain**

London: 17 Bloomsbury Square, W.C.1, 7.30 p.m. F. J. Dyer: 'Biological Standardisation—In Review and Pre-view.'

TUESDAY 6 MARCH

**Society of Chemical Industry**

London: Burlington House, Piccadilly, W.1, 5.30 p.m. R. W. Marsh: 'Some Recent Developments in the Field of Agricultural Fungicides.'

WEDNESDAY 7 MARCH

**Society of Chemical Industry**

London: Royal Institution, Albemarle Street, W.1, 6 p.m. Dr. A. J. Kluyver: 'Microbial Metabolism and its Industrial Implications.'

THURSDAY 8 MARCH

**Royal Institute of Chemistry**

Widnes: Municipal Technical College, 7 p.m. N. Heron: 'The Chemist in Local Government Service.'

Bournemouth: Municipal Technical College, 7.30 p.m. Dr. R. Spence: 'By-Products of Atomic Energy.'

Stirling: Golden Lion Hotel, 7.30 p.m. Professor P. D. Ritchie: 'Stereochemistry of High Polymers.'

**The Chemical Society**

Liverpool: The University, 4.30 p.m. Prof. E. R. H. Jones: 'Polyacetylenes.'

Nottingham: The University, 6.30 p.m. Prof. S. Peat: 'Starch Metabolism in the Higher Plants.'

Cardiff: University College, 6 p.m. Dr. H. W. Thompson: 'Some Aspects of Infra-Red Measurements in Chemistry.'

**Institute of Metals**

Liverpool: Electricity Service Centre, Whitechapel, 7 p.m. Prof. H. O'Neill: 'Atomic Structure and the Hardness of Metals.'

FRIDAY 9 MARCH

**Society of Chemical Industry**

Liverpool: The University, 6.30 p.m. Sir Wallace Akers: 'Industrial Applications of Atomic Energy.'

**The Chemical Society**

Dublin: Trinity College, 8 p.m. Dr. B. Lythgoe: 'The Structure of Macrozamin.'

**Oil and Colour Chemists' Association**

Manchester: The Engineers' Club, Albert Square, 6.30 p.m. R. B. Waters and E. B. Robinson: 'Urethane Oils.'

SATURDAY 10 MARCH

**Institution of Chemical Engineers**

Liverpool: Radiant House, Bold Street. 2.30 p.m. W. L. Howe and A. M. Moult: 'The Reactivation of Bone Charcoal.'

**The Chemical Society**

Exeter: Washington Singer Laboratories. Prince of Wales Road, 2.15 p.m. Discussion: 'Training of Scientists.'

## Technical Trade Exhibition

SCIENTIFIC and industrial research is now accepted as a major factor in our economic welfare. The full value of the work of scientists and technicians can not be adequately developed, however, unless their knowledge is widely disseminated.

With this object in view the Oil and Colour Chemists' Association (London Section) has organised the third Technical Trade Exhibition of raw materials and equipment used in the paint, varnish and printing ink industries, which will be held on 19-21 March, from 2.30 to 8.30 p.m. daily, at the Borough Polytechnic, London, S.E.1.

The latest work on materials, plant and apparatus will be shown by 34 exhibitors.

The electrical conductivity of zinc dust coatings and their anti-corrosive properties will be demonstrated by Amalgamated Oxides (1939), Ltd.

Radioactive tracer techniques and applications of certain colour reaction in chemical analysis will be among developments illustrated by the Paint Research Station.

Stearates, solvents, plasticisers and reodorants will be exhibited by A. Boake, Roberts & Co., Ltd., while the subject of secondary flow will be the main theme of the display by British Industrial Solvents, Ltd.

# The Stock & Chemical Markets

GREATER caution has developed in stock markets owing to a number of factors, chief of which is a wide realisation that the Budget, expected early next month, will bring a further sharp increase in taxation. There is, however, a good deal of speculative activity in shares of companies, results of which are due before the Budget, and which appear to offer reasonable prospects of higher dividends.

Apart from the question of increased taxation it is realised that the future results of many companies must expect to be hit by rising costs. These are in most cases only reflected to a very moderate extent in financial results now coming to hand, as many of them are for a period when the rises in commodity and other prices which followed the Korean war had only just begun to make themselves felt.

After an easier trend, chemical shares tended to attract attention, and strengthened in price. It is being pointed out that even if dividends are not increased, many chemical and kindred shares offer not unattractive yields at current prices. At the time of writing, Imperial Chemical have firmed up to 44s. 10½d. There is, of course, general confidence that the 10 per cent dividend will be maintained.

Chemical shares are also tending to come into rather better demand because some companies will benefit directly or indirectly from rearmament work, which will, of course, help to offset any falling off in other activities. Monsanto at 55s. were firm again on higher dividend hopes, while Fisons have been active at slightly over 27s. Albright & Wilson 5s. shares changed hands up to close on 17s. in anticipation of good financial results. Brotherton 10s. shares were 21s. 3d., and Laporte Chemicals 5s. units 11s. 4½d. Lawes Chemical 10s. shares have changed hands at 12s. 6d. William Blythe 3s. shares were dealt in around 8s. 9d., and earlier in the week F. W. Berk again changed hands around 14s.

Talk of a coming further increase in the price of cement helped cement shares with Associated Cement up to 91s. 9d., while Rugby Cement were good at over 22s. following publication of the financial results. Turner & Newall changed hands around 88s. 6d., and after declining, United Molasses firmed up to 55s. 10½d. on revived market talk that a bonus is in prospect, although whether this will materialise may, of course, depend on whether permission is granted by the Capital Issues Committee. The 4s. units of the Distillers Co. were dealt in around 20s. 6d., British Aluminium were better at 42s. 3d., and General Refractories at 27s. 3d., were active again on hopes of good financial results. But elsewhere, there was a sharp reaction in British Glues & Chemicals to 23s. 3d. following their recent sharp advance.

Triplex Glass have changed hands around 26s. 3d. and United Glass Bottle were 83s. 9d. Glaxo Laboratories were 63s. 9d., and Boots Drug 48s. 6d. Shares of plastics and kindred companies have been well maintained. British Xylonite were 86s. 3d., De La Rue 26s. 6d., and British Industrial Plastics 2s. shares 6s. 9d.

Powell Duffryn eased to 33s. 3d., and Staveley have been active around 88s. 3d. There was again a fair amount of exchanging out of the new nationalisation steel stock into engineering and allied shares, such as Guest, Keen, T. W. Ward, etc., which have been well maintained in price. Tube Investments were £6¾.

Oils fluctuated, but Anglo-Iranian later moved up to £6 on reports of new moves in connection with the Persian oil talks. Shell, after falling to 82s. 6d. rallied sharply to 85s. on general confidence in the market that the dividend will be raised to at least 10 per cent, tax free, and possibly to 12½ per cent, tax free.

Subsequently United Molasses have jumped to 60s. and Borax Consolidated to 63s. 1½d. Both companies have announced share bonuses of 100 per cent.

## Market Reports

THERE has been little alteration in the markets during the past week and in almost all sections the demand is strong relative to the quantities on offer. The flow of orders from the Empire and other overseas destinations continues on a good scale though in many cases firm delivery dates are out of the question. Some form of control for scarce essential raw materials is generally thought to be inevitable. Prices throughout

[continued on next page

# Law & Company News

## Commercial Intelligence

**The following are taken from the printed reports, but we cannot be responsible for errors that may occur.**

### Mortgages and Charges

**(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)**

MURGATROYD'S SALT AND CHEMICAL CO., LTD. (formerly Murgatroyd's Vacuum Salt Co. Ltd.), Sandbach. (M., 3/3/51.) 28 Dec. £953,000 additional 'A' deb. stock secured by Trust Deed dated 14 Dec., 1950. supplemental to deeds dated 31 July, 1947. 28 Jan., 1948, and 31 Oct., 1949. £147,000 additional 'B' deb. stock secured by Trust Deed dated 15 Dec., 1950, supplemental to deeds dated July 31, 1947, 29 Jan., 1948. and 12 Dec., 1949; general charges. *£1,550,000 deb. stock, 12 Oct., 1950.

### Satisfaction

J. J. & J. JENKINS AND ASSOCIATES LTD., London, W., chemists. (M.S., 3/3/51.) Satisfaction, 22 Dec., of charge registered 16 April, 1946.

### Increases of Capital

The following increases of capital have been announced: BRITISH INDUSTRIAL HOLDINGS, LTD., from £55,000 to £75,000; LIFEGUARD PRODUCTS LTD., from £40,000 to £60,000.

## Company News

### Negretti and Zambra, Ltd.

Profit for the year ended 30 September, 1950 of Negretti and Zambra, Ltd., was £163,114 (£159,648). A final dividend of 15 per cent (10 per cent) is recommended on ordinary shares making 19 per cent (14 per cent).

### Redfern's Rubber Works, Ltd.

Consolidated profit of Redfern's Rubber Works, Ltd., for the year ended 31 December, 1950 (before providing for taxation) was £58,663 compared with £72,839 in 1949 and £105,394 in 1948. The directors recommend a final dividend of 5 per cent on ordinary shares, plus a bonus of 5 per cent. less tax. The chairman, in his report, referred to the new problems which had to be faced caused by short supplies of zinc oxide and sulphur, both important to the rubber industry.

## Market Reports

*continued from previous page*

the industrial chemicals market are firm with a tendency to go higher and for a number of items not immediately available quotations are nominal. A strong tone is again in evidence in the coal tar products market and makers have little to offer for near delivery. American duty free cresylic acid is in good call with the price again advanced.

MANCHESTER.—Values remained firm in all sections of the Manchester chemical market. Since the last report further advances have been noted in the copper compounds, with sulphate rather more than £5 a ton dearer. Home users are pressing for contract deliveries and there has been plenty of fresh inquiry for the alkalis and other leading heavy chemicals both for home consumption and export. A fair amount of new business in sulphate of ammonia and other fertiliser materials has been placed during the past week. Tar products generally were on a strong price basis and in a number of sections it is now difficult to place orders for short delivery.

GLASGOW.—The heavy chemical market is still showing strong evidence of stock piling and inquiries for supplies are exceedingly numerous, and it is obvious that the various shortages and curtailed supplies are having a serious effect.

# CLASSIFIED ADVERTISEMENTS

## SITUATIONS VACANT

**ANALYTICAL CHEMIST,** A.R.I.C, B.Sc., A.I.R.I., or equivalent required by well established Company in Croydon area. Pensions Scheme, canteen, Sports and Social Club. Applicants should be under 26. Commencing salary £450–£525 p.a., depending on qualifications and experience. Particulars to Box No. C.A. 2994, THE CHEMICAL AGE, 154 Fleet Street, London, E.C.4.

ANGLO-American Company producing cellulose for the chemical and allied industries, require a **QUALIFIED CHEMIST** for laboratory and process control work. Experience in our field not necessary. Age 20–30. Salary not less than £500. Applications, giving full details of education and qualifications to: CHIEF CHEMIST, The Holden Vale Manufacturing Company Limited, Haslingden, Lancashire.

**ASSISTANT CHEMIST** required by medium/large engineering concern in Slough, engaged in the manufacture of Motor Engine Components, and Cork Products. A good opportunity for a young man of 22/26 years of age, who has completed his military service and has attained at least an inter-B.Sc. Works laboratory experience would be a desirable qualification. Salary according to experience, etc. Write, stating age, etc., to PERSONNEL MANAGER, Box No. CA. 2993, THE CHEMICAL AGE, 154 Fleet Street, London, E.C.4.

**CHEMICAL ENGINEER,** A.M.I.Chem.E., required for designing heavy chemical plant. Please apply to BAMAG, LTD., Rickett Street, London, S.W.6, quoting Reference JW.

OIL Refinery Contractors handling large contracts for Refinery Plant, require **CONTRACT ENGINEERS** in their London Office. Duties involve broad direction and co-ordination of all phases of the work, including planning, drafting, purchasing, progressing and erection. Desirable qualification is previous experience of Refining Industry or Heavy Engineering, including a wide knowledge of pumping, heat-exchange equipment and instrumentation, and the appointment offers excellent prospects to suitable men. Applicants should write fully, stating qualifications, age and experience, to **Foster Wheeler, Ltd., 3, Ixworth Place, London, S.W.3.**

**PLANT DEVELOPMENT AND PROCESS ENGINEERS,** qualified in Chemical Engineering or Petroleum Refining Technology, required by Bahrein Petroleum Company, Limited. Age limit, 25-40. Two-year agreement periods with passages and paid leaves. Free air-conditioned accommodation, board and medical attention, kit allowance, low living costs. Salary according to experience. Write, with full particulars of age, education, experience, to **Box 3784, c/o Charles Barker & Sons, Ltd., 31, Budge Row, London, E.C.4.**

**RESEARCH CHEMIST** required for electrochemical work, principally connected with nickel plating and allied processes, in the laboratories of a large light engineering firm in the Midlands. Applicants must have had sound chemical training and hold honours degree or its equivalent. Previous experience in this type of work will be considered a distinct advantage. Applicants should write, stating age, experience, qualifications and salary required. Box No. C.A. 2992, THE CHEMICAL AGE, 154 Fleet Street, London, E.C.4.

## SITUATIONS VACANT

**QUALIFIED CHEMIST** required to take charge of works laboratory in large Heavy Organic Chemical Works in the Midlands. Experience of laboratory control essential. Salary according to age, qualifications and experience. A contributory pensions scheme is in operation. Apply to Box No. C.A. 2986, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

THE Civil Service Commissioners invite applications for permanent appointments as **ASSISTANT EXPERIMENTAL OFFICER.** Interviews will be held shortly after the receipt of the completed application form and successful candidates may expect early appointments.

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